Transforming the North

Strategic Options for the Darwin to Townsville Economic Corridor

Advisian
WorleyParsons Group

Purpose of this Paper

The objectives of this Paper are to:

- Generate options to advance the Mount Isa to Tennant Creek Rail link (MITCR) and consider how it could transform northern Australia
- Enhance understanding of the existing economics of the Townsville to Darwin supply chain and transport corridor including consideration of:
  - Potential demand volume scenarios, including impacts of changes in commodity prices and volumes
  - Potential scenarios under which the MITCR would be economically viable
  - The impact on Australia's competitiveness should the MITCT not progress
  - Approaches to manage the economic and commercial risks
  - The value of the positive and negative externalities associated with the project.
- Identify and evaluate opportunities to increase the benefit the MITCR could have on regional economic development, including:
  - Maximise impacts on mining and agricultural competitiveness, sustainability and profitability
  - Facilitate new sources of growth and income in addition to enhancing existing or emerging industry
  - Potential for rail operators and local businesses to benefit from second round, transformative impacts, which would include consideration of big picture benefits that may not be immediately apparent.
- Determine levels of possible interest and sources of capital (both domestic and foreign) to finance the MITCR
- Generate options to attract private proponents to execute the project, including:
  - Through utilising the Northern Australia Infrastructure Facility (NAIF)
  - By value capture and/or creation.
- Assess the potential for the MITCR to be a successful infrastructure investment
- Assess the impact the MITCR may have on existing supply chain infrastructure
- Investigate an effective charging regime on the railway
- Investigate risk allocation between stakeholders.

Disclaimer

This Paper has been prepared on behalf of and for the exclusive use of Commonwealth, Queensland and Northern Territory Governments. It is subject to and issued in accordance with the agreement between the three Governments and Advisian.

All analyses and conclusions drawn do not represent a policy position or opinion of the Commonwealth, Queensland or Northern Territory Governments.

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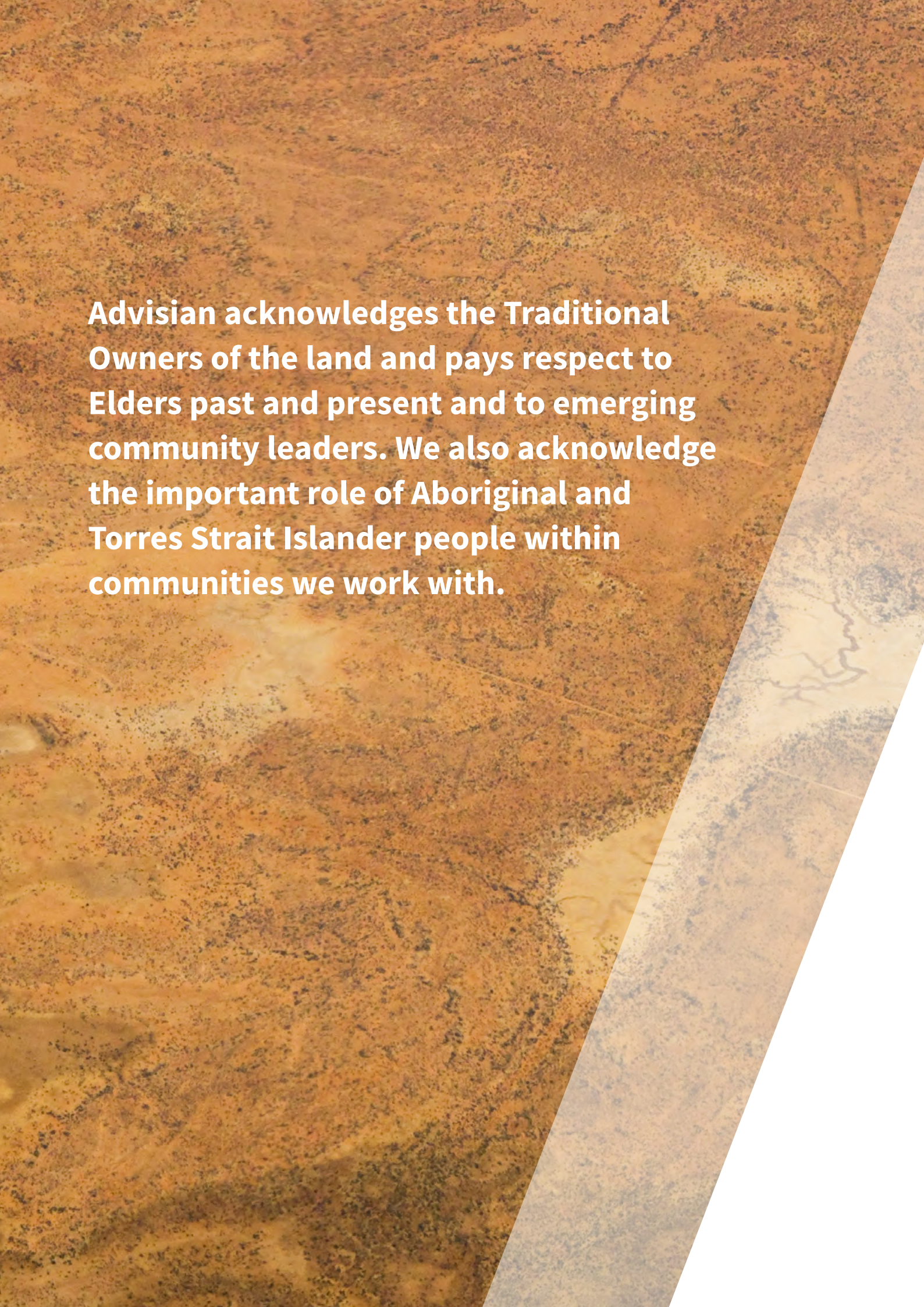

Advisian acknowledges the Traditional Owners of the land and pays respect to Elders past and present and to emerging community leaders. We also acknowledge the important role of Aboriginal and Torres Strait Islander people within communities we work with.

Traditional owners

The MITCR corridor traverses land under the stewardship of the Traditional Owners, who are represented by the Central Land Council (CLC) and Northern Land Council. The land is rich in Aboriginal cultural heritage and is crossed by many ancient trading routes and songlines.

In the Central Land Council's region, traditional Aboriginal landowners own 407,985 square kilometres of Aboriginal freehold land under the Aboriginal Land Rights Act. This represents more than 52 percent of the 776,549 square kilometres of land covered by the CLC's nine regions.

The Northern Land Council is spread over seven regions:

- Darwin / Daly / Wagait
- West Arnhem
- East Arnhem
- Katherine
- Victoria River District (VRD)
- Ngukurr
- Borroloola / Barkly.

Preface

On 18 June 2015 the Commonwealth Government released its White Paper on Developing Northern Australia which included funding for analyses of rail freight projects in northern Australia, with an initial focus on the proposed Mount Isa to Tennant Creek Rail link (MITCR).

On 11 December 2015, the Northern Territory and Queensland Governments announced a Memorandum of Understanding (MOU) to undertake a joint approach to progress the MITCR. A Cross-Border Infrastructure and Investment Steering Committee (CBIISC) was established with representatives of the Queensland and Northern Territory Governments to facilitate this joint approach.

The Darwin to Townsville corridor is the backbone of most economic activity in north east Australia. Almost one tenth of Australia's land mass can be found within a 250 kilometre distance of this corridor and it is home to approximately 350,000 Australians. It includes:

- The ports of Townsville and Darwin
- One of the world's leading base metals districts with potential undeveloped mineral resources
- Australia's two largest military bases.

The region has the potential to provide mineral resources and food to the rapidly growing Asian market, with Darwin anchoring the eastern end of the One Belt One Road (OBOR) Chinese economic initiative.

Advisian was appointed by the Commonwealth, Queensland and Northern Territory Governments in September 2016 to produce a *Strategic Options Paper for a Mount Isa to Tennant Creek Rail Link*. The Paper analyses the Darwin to Townsville economic corridor including current government policies, economics, potential financing and external drivers. Extensive research and stakeholder engagement with governments, industry bodies and the private sector was conducted to provide an insight into various perspectives on the project.

Economic modelling, conducted by The Centre of International Economics (The CIE) shows that constructing infrastructure, combined with targeted policy reforms and the right market conditions, can have a positive economic impact on the Gross State Product (GSP) of the region. This flows through to a positive economic effect on Australia's Gross Domestic Product (GDP). Conversely, under a scenario where no action is taken, either through not constructing infrastructure or no targeted policy reform, the economic contribution of the corridor potentially could reduce, as existing known and developed mineral resources are exhausted.

Under the current risk environment the project is not commercially attractive to institutional investors. However, some private sector logistics operators see the potential for this link in the medium to long term. The key to mobilising this private sector interest further is government facilitated de-risking in three key areas, by providing:

- Clear guidance on land use planning and economic development precincts
- More certainty in regard to potential traffic in the corridor
- A better understanding of the cost and ease of constructing the rail link.

This Paper and its companion papers by The CIE provide an insight into the complex nature of progressing this project. It considers seven potential infrastructure options, three of which are assessed as having merit from an infrastructure perspective to consider further. The Paper recommends a staged approach, leveraging the relative strengths of the private sector and government to incrementally de-risk the project and grow private sector interest.

This paper should be read in conjuction with reports from The Centre for International Economics

- Economic analysis of the Mount Isa to Tennant Creek Railway
- Commercial and financial analysis of the Mount Isa to Tennant Creek Railway

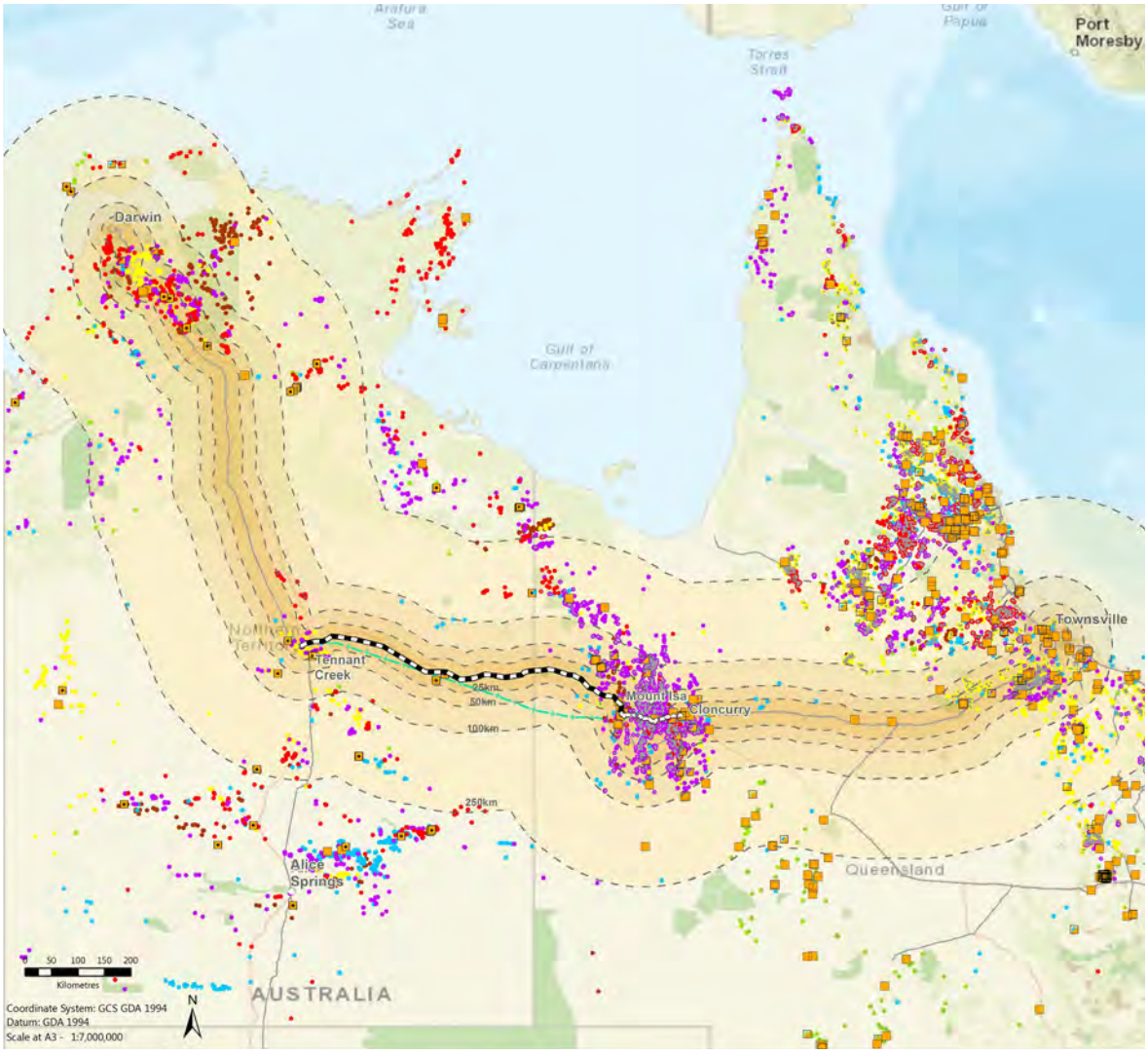

Figure 1: The eastern side of northern Australia showing MITCR and clusters of mineral resources

Nomenclature

Abbreviation	Description
AADT	Annual average daily traffic
AGMS	Automated Geometry Measuring System
ALC	Australian Logistics Council
ALRA	Aboriginal Land Rights Act 1976 (Northern Territory)
APCT	Abbot Point Coal Terminal
ARA	Australasian Railway Association
ARC	AustralAsia Railway Corporation
ATEC	Australian Transport and Energy Corridor
CG	Coordinator-General
CID	Community Infrastructure Design
CIE	The Centre for International Economics
CQCN	Central Queensland Coal Network
CRB	Commodity Research Bureau
CRBC	China Road and Bridge Corporation
DAP	Diammonium phosphate
DBCT	Dalrymple Bay Coal Terminal
dECI	Double early contractor involvement
DIPL	Department of Infrastructure, Planning and Logistics (Northern Territory Government)
DoD	Department of Defence
EA	Environmental Assessment Act
EAAP	Environmental Assessment Administrative Procedure
EIS	Environmental Impact Assessment
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
GBRWHA	Great Barrier Reef World Heritage Area
GCC	Gulf Cooperation Council
GDO	Gross domestic product
GFC	Global Financial Crisis
GL/year	giga litres per year
GNR	Great Northern Railway
GRP	Gross regional product
GSP	Gross state product
HPCT	Hay Point Coal Terminal
HV	Heavy vehicle
ILC	Indigenous Land Corporation
ILUA	Indigenous Land User Agreement
IoT	Internet of Things
JTWG	Joint Technical Working Group
kg/m	kilograms per linear metre
MAP	Mono-ammonium phosphate

MBIR	Melbourne-Brisbane Inland Rail
MIRL	Mount Isa Rail Line (also known as the Great Northern Railway)
MITCR	Mount Isa to Tennant Creek Rail Link
MITEZ	Mount Isa to Townsville Economic Zone
MNES	Matter of National Environmental Significance
mt	Million tonnes
mtpa	Million tonnes per annum
NAIF	Northern Australia Infrastructure Facility
NCL	North Coast Line
NGP	Northern Gas Pipeline
NHVR	National Heavy Vehicle Regulator
NQBP	North Queensland Bulk Ports Corporation
NT Act	Native Title Act 1993
NTC	National Transport Commission
NT EPA	Northern Territory Environment Protection Authority
ntk	Net-tonne kilometre
OBOR	One Belt One Road
OID	Overcoming Indigenous Disadvantage
PBS	Performance based standards
PC	Productivity Commission
PEP	Port Expansion Project (Port of Townsville)
PER	Public Environmental Report
PIF	Private Infrastructure Facility
RAP	Regulatory approvals plan
RISSB	Rail Infrastructure Standards and Safety Bureau
SDA	State Development Area
SDPWO Act	State Development and Public Works Organisation Act 1971
SIP	State Infrastructure Plan
SOP	Strategic Options Paper
SP Act	Sustainable Planning Act 2009
SPV	Special Purpose Vehicle
tal	tonne axel load
TEARC	Townsville Eastern Access Rail Corridor
TEU	Twenty-foot equivalent unit
TMR	Department of Transport and Main Roads (Queensland Government)
TraNSIT	Transport Network Strategic Investment Tool
TSDA	Townsville State Development Area
WACC	Weighted average cost of capital
WICET	Wiggins Island Coal Export Terminal

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Appendices are located in accompanying document

Executive Summary

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Key messages

A railway line between Mount Isa and Tennant Creek would enable rail connectivity between the economic centres of Darwin and Townsville and further add to a national rail network.

However regional economic activity and market demand does not necessitate or support short to medium term construction of a rail line.

Key message 1:
The desired outcome of the MITCR is increased economic growth in northern Australia for the benefit of all Australians. However, solely building a new asset is not likely to provide the desired outcome. Policy reform combined with the right market conditions could maximise economic growth in northern Australia and increase the ease of investing and doing business for private firms.

Key message 2:
Constructing a rail link between Tennant Creek and Mount Isa is not currently commercially viable. Current volumes in the corridor can be managed with the existing transport network. The existing rail infrastructure is not utilised to capacity. As economic activity increases, traffic will exceed the capacity of the road network and there will be more pressure on the existing rail infrastructure to operate towards its capacity. As rail demand approaches its capacity, a rail link between Tennant Creek and Mount Isa will be required, provided there is sufficient demand originating from within the immediate area. It should be noted that some economic traffic such a bulk minerals is more suitable for rail than others such as certain types of agriculture.

Key message 3:
International freight and commodity markets are becoming increasingly competitive. Without comparable investments in efficient multi-modal systems, the competitiveness of Australian exports may diminish. Improving efficiency of the Darwin to Townsville corridor as a multi-mode supply chain may be one way of maintaining competitive transport costs

Key message 4:
There are broader strategic issues that need to be considered when analyzing the MITCR project and development of the transport corridor. For example, what additional investments are required in complimentary infrastructure (water and energy in particular) that would be required to facilitate growth in industries along the corridor? What are the wider social impacts associated with improved transport infrastructure along the corridor?

Key message 5:
A continued coordinated effort is required by relevant governments to increase the ease of doing business for private firms in northern Australia. Currently, there are risks associated with the MITCR project that discourage private sector investment. These risks are world commodity prices, commencement of resource projects, projected freight traffic on the line, likely governance structure or regulatory regime, access to the corridor and possible time to obtain some approvals. Targeted actions by governments to address project-specific risks will encourage private sector interest and enable the project to be progressed sooner when the case for its development improves.

The CIE *"While there will be a short-term impact from the investment phase, there will also be enduring benefit from the new infrastructure over the long term. However, in the current investment environment, that benefit will be limited. Sustaining benefits over the longer term will rely on the new rail line stimulating economic growth in the region."*

The CIE *"Over the long term, what are required are economic reforms that de-risk the investment environment and enable the development of the corridor's resources by the private sector. This requires an integrated approach that links the construction of the MITCR to wider economic reforms."*

Recommendations

Recommendation 1:

The work of the Joint Technical Working Group (JTWG) should continue to de-risk the project from a technical perspective.

Recommendation 2:

Initiate actions to stimulate economic activity and create an environment where private sector investment will be encouraged. The governments should continue working in partnership to:

- Increase certainty about mineral deposits
- Increase land use flexibility, in particular pastoral lease areas
- Identify high priority economic development precincts
- Develop a corridor master plan
- Facilitate resolution of native title rights and ensure sufficient resource allocation for Indigenous Land Use Agreement (ILUA) negotiations in development precincts
- Streamline approval processes for high priority development precincts
- Determine corridor infrastructure requirements.

Creating one point of contact for the private sector for the Darwin to Townsville corridor would improve the effectiveness of private sector engagement.

Recommendation 3:

A market sounding should be considered following further progression of the JTWG work program, broader government actions to facilitate economic activity, and confirmation of an improved outlook for demand along the corridor. A market sounding will enable the Governments to better gauge private sector interest and the extent to which operators are willing to be involved in the realisation of MITCR. This market sounding could be aimed at commercial operators and be protected by Confidentiality Agreements (CA).

The innovative capability of the private sector should not be underestimated. This is even more the case in Australia now than 10 years ago due to the movement of many major international infrastructure sector companies into Australia driving new levels of competitiveness to deliver infrastructure and operate infrastructure.

Next steps for the Darwin to Townsville corridor

Government partnership priorities could be progressed via a corridor master plan.

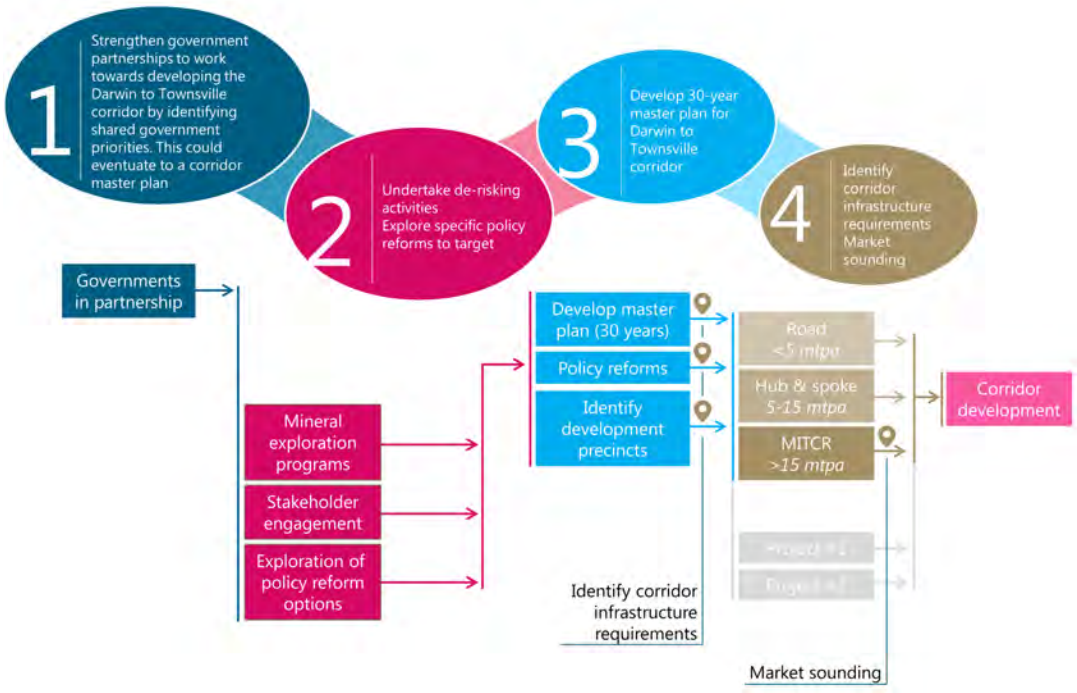


Figure 2: Suggested possible future course of action

Government partnership priorities could be progressed via a corridor master plan. The master plan would collate known information, stakeholder input and planned investigations.

This master plan would take a triple bottom line approach (economic, social and environmental) to the identification of "precincts" along the corridor. These government and community identified precincts would provide the certainty that could frame policy reforms and encourage private sector innovation and entrepreneurial initiatives. The precincts could be diverse as:

- Agriculture precinct
- Aquaculture precinct
- Base metal precinct
- Beef precinct
- Phosphate/fertiliser precinct
- Thermal coal precinct
- Tourism/cultural precinct.

The four pillars of each precinct will generally be:

- The specific natural resource
- Water
- Power
- Transport infrastructure.

The master plan would describe a staged approach to incrementally develop these. For transport it could move through these stages:

- Optimise use of existing road and rail infrastructure; and when this is nearing capacity (less than 5 mtpa)
- Encourage existing rail links to be effective "hub-and-spoke" operations (between 5 and 15 mtpa); then
- Plan to connect Mount Isa and Tennant Creek when sufficient economic traffic is developing.

Policy drivers

Developing northern Australia is at the confluence of many key policies and strategy documents from all three governments

Enhancing the Darwin to Townsville transport corridor as an asset to drive economic growth is a clear action to address a number of core government policies. The cornerstone policy document in this regard is the Commonwealth Government's "**Our North, Our Future: White Paper on Developing Northern Australia" (2015)**. In this policy, a commitment is made:

"We will drive down the costs of operating in the north for business; making it a more attractive place to invest and work. By making the right regulations and infrastructure investments, we can encourage jobs and tackle the costs of living far from major cities." [1]

Developing northern Australia is at the confluence of many key policies and strategy documents from all three governments, as seen in Figure 3. These policies include:

- The Northern Territory Government's Economic Development Strategy 2016
- The Queensland Government's *State Infrastructure Plan* and *Advancing North Queensland*

Programs underway

The following programs are still in early days and have not yet increased certainty and understanding of the Darwin to Townsville corridor.

- North Australia Infrastructure Facility
- Exploring for the Future drilling program

Policy relevance to MITCR

A number of Commonwealth and State Government infrastructure policies are relevant to the Darwin to Townsville corridor. These policies are shown chronologically with their interfaces mapped in Figure 3.

The Northern Territory Government's Economic Development Framework 2017

The Northern Territory recognises that infrastructure is the foundation of economic and social development and notes that "Accelerating economic growth can be facilitated strategic public sector investment that acts as a catalyst for private sector investment". The Northern Territory is undertaking investigations of the MITCR.

The Queensland Government's State Infrastructure Plan and Advancing North Queensland

The MITCR is not mentioned in the Strategic Infrastructure Plan (SIP) or the Advancing North Queensland document (ANQ); however, both documents recognise the need to upgrade the Mount Isa to Townsville rail link. The ANQ makes specific mention of a $25 million upgrade to the rail line.

[1] Commonwealth of Australia 2015b, p.IV

Policy relationships and chronology map

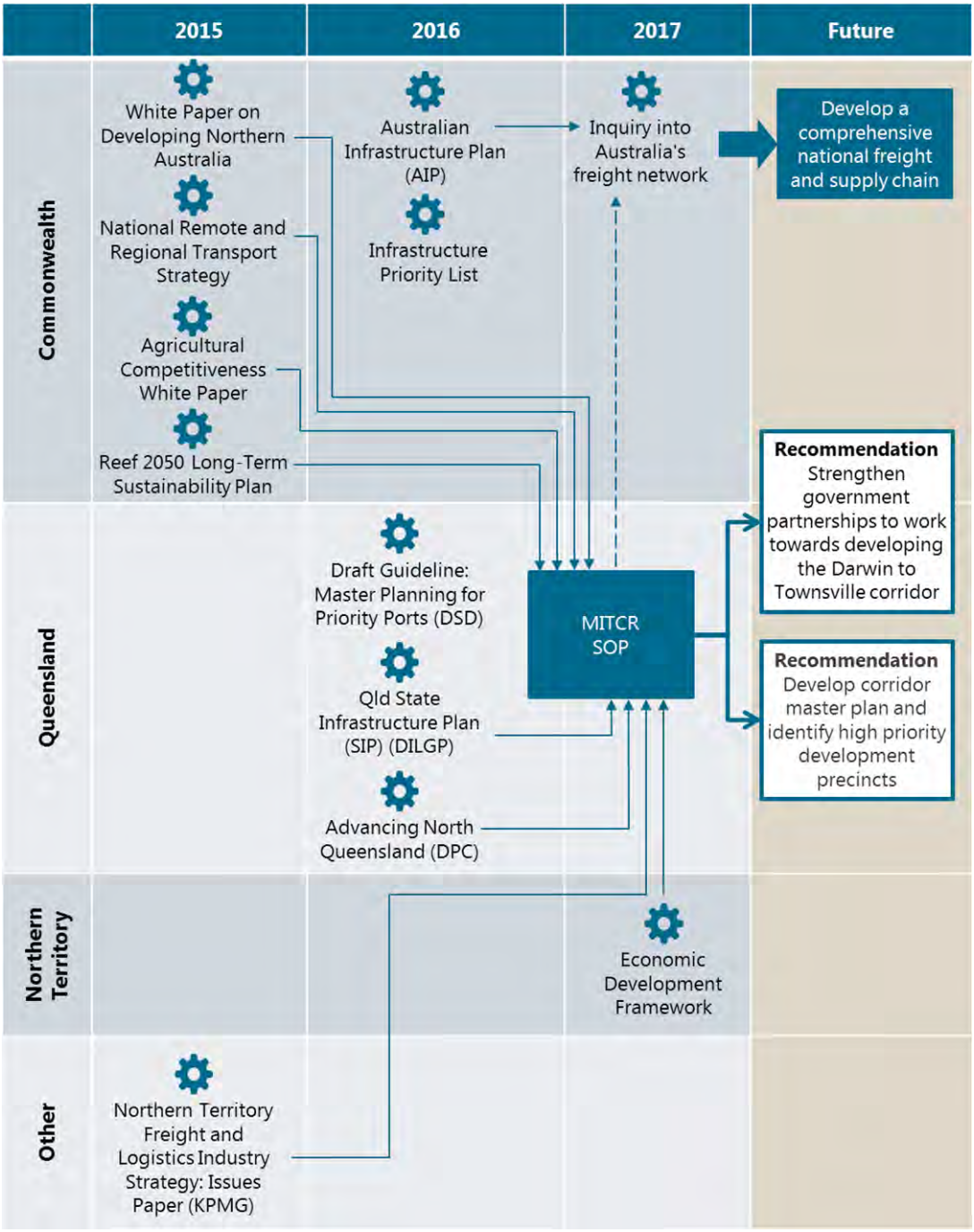


Figure 3: Map of policy documents post 2014

Economics and national competitiveness

Effective coordinated land-use planning will assist in determining the extent to which economic development can be enhanced or created along the Darwin to Townsville economic corridor.

A well-designed nation-wide freight network could improve Australia's access to developing markets in Asia.

Modelling inputs

Market demand

Corridor production forecasts for the period from 2016 to 2025 are based on available global market demand forecasts that incorporate the most up to date and reliable information. Beyond 2025, commodity prices for each scenario are estimated in real terms based on the following:

- Market demand prospects: growth in demand for commodities is a function of world economic growth as reflected by global GDP.
- Supply-side developments: increases in agricultural land, new mineral resources and improved productivity improve supply-side conditions.

Policy reforms

The baseline and investment scenarios assume no action is taken on policy reform along the Darwin to Townsville corridor and that the current rate of production decreases as mines deplete their reserves and/or come to the end of their production plans. No new mines are assumed to open in these scenarios.

The Low, Medium and High demand scenarios assume that reforms improve the supply environment, allowing high, medium and low quality resource deposits to be mined depending on market conditions.

Table 1 illustrates key inputs into the computable general equilibrium (CGE) model with five different scenario outcomes.

	Scenario	MITCR construction*	Economic growth in key Asian markets	Avgerage world economic growth - 2020 onwards	Exchange rate
No policy reform	**Baseline**	NO	N/A**	N/A**	N/A**
	Investment phase	YES	N/A**	N/A**	N/A**
Policy reform	**Low**	YES	China at 5.5% by 2030 India at 6.3% by 2030	3.3%	AU$1.00 to US$0.60
	Medium	YES	China at 5.8% by 2030 India at 7.8% by 2030	3.5%	AU$1.00 to US$0.70
	High	YES	China at 7.6% by 2030 India at 8.5% by 2030	4.3%	AU$1.00 to US$0.80

Table 1: The CIE economic forecast model assumptions

** MITCR construction refers to the construction of infrastructure Option 2B*

*** No inputs required as these scenarios assume exiting mines produce until the end of life or end of production plan. No new mines open in these scenarios.*

Policy reform

Policy reform in the below areas in conjunction with suitable market conditions can be a key enabler to increase private sector confidence and the longevity of economic impacts.

Land tenure and native title

Some native title lands in Queensland and the Northern Territory have not yet been claimed or are still in determination. This potentially discourages economic development. Policy reform should look to facilitate resolution of native title rights and encourage negotiation of Indigenous Land Use Agreements (ILUA). It should be noted that a legal framework has been established to resolve these issues. Identification of a clear Darwin to Townsville economic corridor could provide a means to focus resolution of critical specific issues to enable economic development.

Pastoral leases

Pastoral leases generally allow land to be used for livestock grazing purposes. Pastoral leases are typically long term and large in area, often requiring additional permits and approvals for the land to be used for other purposes. In the Northern Territory, approval by the relevant minister is also required. The inability to divide pastoral lands into smaller lots further adds to the inflexibility of its use. Reform around the laws governing the use of pastoral land should seek to limit restrictions on pastoral land use and increase transferability.

Environmental approval processes

In some cases larger projects need to obtain both State/Territory and Commonwealth Government approvals. Many companies cite the environmental impact statement (EIS) approval processes to be unclear, leading to ambiguity and increased exposure to risk. This discourages private sector investment. By clarifying EIS approval processes along the Darwin to Townsville corridor, governments could increase private sector interest and stimulate investment along the corridor.

Facilitating development of the corridor

The use of legislation for policy reform may be more easily achieved on a case by case corridor basis targeted at specific economic outcomes. The Surat Basin Rail Act 2012 is one example of legislation enacted by the Queensland Government to assist in the development of a major infrastructure project with economic benefits to the state. The Surat Basin Rail (Infrastructure Development and Management) Bill 2012 was presented to the Queensland Government in September 2012 with the objective of facilitating the development and operation of the Surat Basin Rail Project. This bill was legislated and made provisions that allowed the Surat Basin Rail project corridor to be secured, in particular, the land tenure associated with the railway's intersections with roads and watercourses corridors.

[2] Jackson & Green 2017, p.55

Economic modelling outputs

The economy at Mount Isa is heavily reliant on base metal production and the Phosphate Hill fertiliser facility. Although these appear to be separate operations, they are all part of an interconnected chemical supply chain whereby one operation is inextricably linked with the other.

Tables 2 to 4 illustrate the potential value creation attainable under each economic demand scenario. This assumes MITCR construction occurs in parallel with policy reforms and market conditions are sound.

Figures 4 to 6 illustrate Gross Regional Product (GRP) and corridor production levels with MITCR construction, under different economic demand scenarios, with and without policy reforms taking place.

"The priority of the three governments should not be the throughput on the railway. Rather, value creation from the railway will primarily come from increasing economic activity, which can be 'captured' through royalties, income taxes and other taxation streams."

"The MITCR concept is not built on the transportation of coal for export at the port of Darwin; however, the MITCR line may support small 'displaced' volumes of other commodities."

Estimated government value capture from selling resources packages for 20% of expected value: 2022 to 2035

Scenario MITCR Strategy	Total Increase $b	NPV of total increase $b
Low price scenario	2.6	1.5
Medium price scenario	5.7	3.4
High price scenario	8.4	4.9

Note: These estimates were developed using an estimate of resource value per tonne ($100) multiplied by The CIE's estimates of increased total tonnes of product exported. NPV was estimated in 2016 dollars and discounted by 5% WACC. Source: The CIE.

Table 2

Estimated increase in royalties for the Queensland Government: 2022 to 2035

Scenario MITCR Strategy	Total Increase $m	NPV of total increase $m
Low price scenario	127.7	77.3
Medium price scenario	286.0	170.0
High price scenario	420.1	245.8

Note: These estimates were developed using an average Queensland royalty per tonne of coal ($8.15) multiplied by The CIE's estimates of increased total tonnes of product exported. NPV is estimated in 2016 dollars and discounted by 5% WACC. Source: The CIE.

Table 3

Estimated additional resources exported: 2022 to 2035

Scenario MITCR Strategy	Total Increase $b	NPV of total increase $b
Low price scenario	12.8	7.7
Medium price scenario	28.6	17.0
High price scenario	42.0	24.6

Table 4

Projected GRP without policy reform

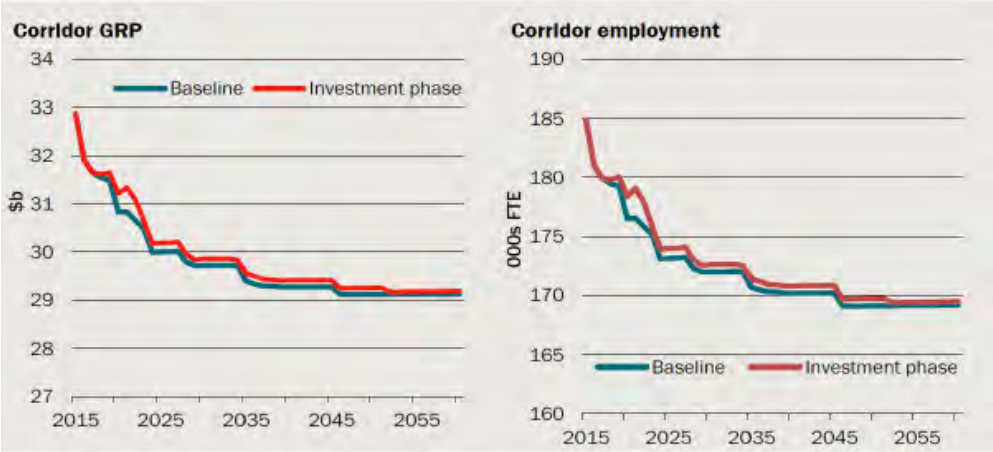


Figure 4: Baseline - no policy reforms (no construction of MITCR)

Investment phase - no policy reforms (with construction of MITCR)

GRP with MITCR construction under high, medium and low demand scenarios

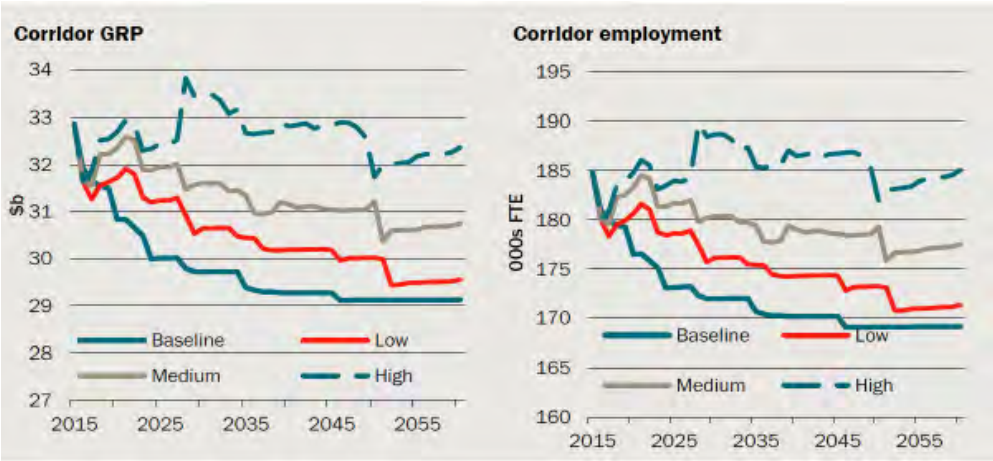


Figure 5: Baseline - no policy reforms (no construction of MITCR)

High/Medium/ Low - GRP with construction of MITCR Option 2B and undertaking policy reforms

Gross value of production from MITCR corridor

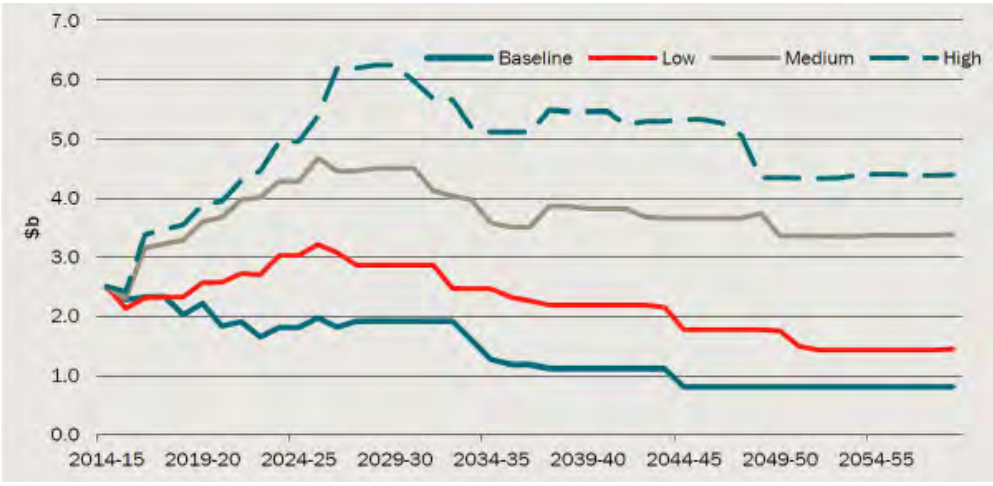


Figure 6: Baseline - no policy reforms (no construction of MITCR)

High/Medium/ Low - GRP with construction of MITCR Option 2B and undertaking policy reforms

Economic analysis of the corridor

Modelling by The CIE shows that constructing the MITCR project in parallel with policy reforms could have a positive effect on the GRP contribution of the Darwin to Townsville corridor. However, construction of the MITCR project alone would not enable long-term economic growth along the Darwin to Townsville corridor.

Table 5 summarises territory, state and national expenditure and economy estimates under different demand and infrastructure scenarios. This analysis is based on developed and undeveloped known resources. The Low demand scenario is based on existing developed resources and high quality known undeveloped resources. The High demand scenario is based on all known resources, developed or currently undeveloped. Any new resources identified during exploration will be additional to this.

"...the volumetric capacity of the infrastructure servicing the Mount Isa to Townsville corridor is largely adequate to deal with the forecast commodity growth in the longer term."

				Australia		Queensland		Northern Territory	
Do not construct	No policy reform	Capital expenditure	$bn	0.0		0.0		0.0	
		GSP in 2035 (lost opportunity)	$bn	-7.9		-4.9		-0.01	
		GSP projection 2016-2035 (lost opportunity)	$bn	-65.5		-40.8		-0.25	
		Employment in 2035	FTE	-34, 200		-23, 100		small	
	Demand Scenario			Low	High	Low	High	Low	High
	With policy reform	Capital expenditure	$bn	0	0	0	0	0	0
		GSP in 2035 (lost opportunity)	$bn	-5.2	8.6	-3.3	5.4	0.0	0.2
		GSP projection 2016-2035 (lost opportunity)	$bn	-43.5	69.9	-27.1	43.4	0.1	1.1
		Employment in 2035	FTE	-22, 200	38, 500	-15, 200	25, 000	250	365
Construct*	No policy reform	Capital expenditure	$bn	3.4	3.4	3.4	3.4	3.4	3.4
		GSP in 2035	$bn	-7.4	-6.4	-4.7	-4.1	0.0	0.0
		GSP projection 2016-2035	$bn	-60.2	-56.6	-38.7	-36.8	0.6	0.7
		Employment in 2035	FTE	-32, 400	-28, 400	-21, 900	-19, 200	50	245
	With policy reform	Capital expenditure	$bn	3.4	3.4	3.4	3.4	3.4	3.4
		GSP in 2035	$bn	-4.8	10.1	-3.0	6.2	0.0	0.2
		GSP projection 2016-2035	$bn	-38.2	70.9	-24.9	42.5	0.9	2.0
		Employment in 2035	FTE	-20, 400	44, 234	-14, 000	28, 859	300	610

Table 5: Summary of capital expenditure, Gross State Product (GSP) and employment estimates
**Construct refers to the construction of MITCR Option 2B*

Viability of the MITCR in the Darwin to Townsville corridor

Economic viability of the MITCR project as a successful infrastructure investment is dependent on a base load of traffic which does not currently exist.

This base load could be reliant upon the identification of viable resource deposits, effective governance regimes and joint government effort to encourage increased economic activity.

Advisian suggests that effective coordinated land-use planning will assist determining the extent to which economic development can be enhanced or created along the Darwin to Townsville economic corridor. Identifying suitable areas as development precincts would create increased certainty around potential traffic volumes. As these precincts are enhanced or developed, tonnages on the corridor will increase until the point where rail infrastructure will be required for an effective supply chain.

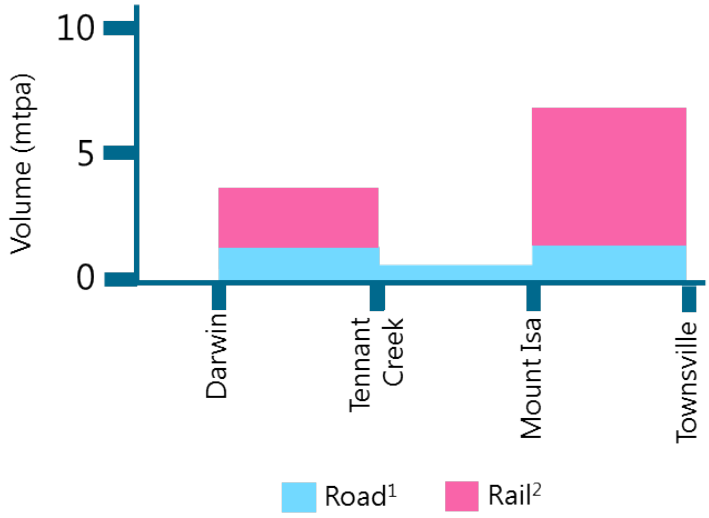
Current freight volumes along the Darwin to Townsville corridor are as illustrated in Figure 7.

Australia's freight task

Australia's domestic freight is forecast to grow by 80 percent between 2010 and 2030[3], reinforcing the importance of effective supply chains. Effective supply chains are multi-mode systems where each transport mode is used to leverage its specific strengths.

There are cases of modal shift occurring along routes from Perth to Adelaide, Adelaide to Darwin and on the east coast. Engagement with the private sector indicates that, since completion of the Adelaide to Darwin railway link, freight volumes transported by rail have increased approximately four fold.

Inland Rail and Townsville Eastern Access Rail Corridor (TEARC) are just two examples of government initiatives to move to efficient multi-mode supply chains. The $10.7 billion dollar Inland Rail project illustrates the seriousness of the Government's intent on driving these type of initiatives.



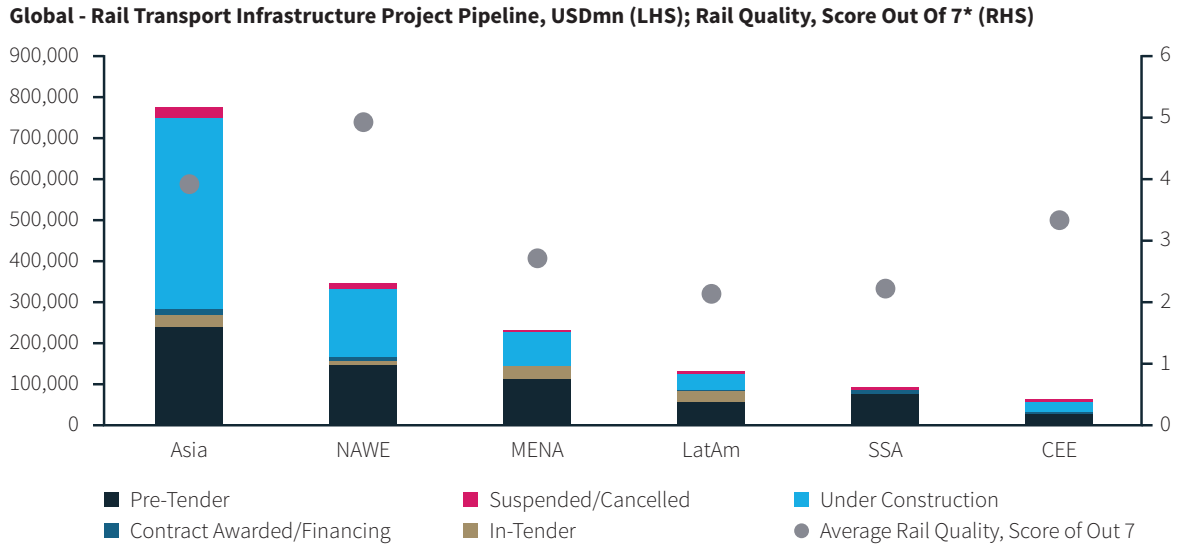
[1] Information obtained from QGlobe (2015 data)
[2] Approximate volumes obtained from Queensland Rail and Genesee & Wyoming pers. Comms
Note: volumes between Darwin and Tennant Creek include volumes travelling from Darwin to Adelaide

Figure 7: Darwin to Townsville corridor freight volumes (measure of volume travelling in both directions)

[3] Commonwealth Government Department of Infrastructure and Regional Development 2014, p.8

National competitiveness

Extensive investments are being made by some countries in transport infrastructure to enable development. China is investing heavily in Africa as part of its ambitious One Belt One Road (OBOR) 21st Century Silk Road initiative. Other parts of Asia are also investing in transport infrastructure, as shown in Figure 8, which illustrates relative investments into rail globally.



**Higher rail quality scores indicates higher perceived quality of rail infrastructure. NAWE = North America & Western Europe.*

Figure 8: Global rail project pipeline *Source: World Economic Forum BMI*

In contrast, rail expenditure in Australia appears to be plateauing, refer Figure 9.

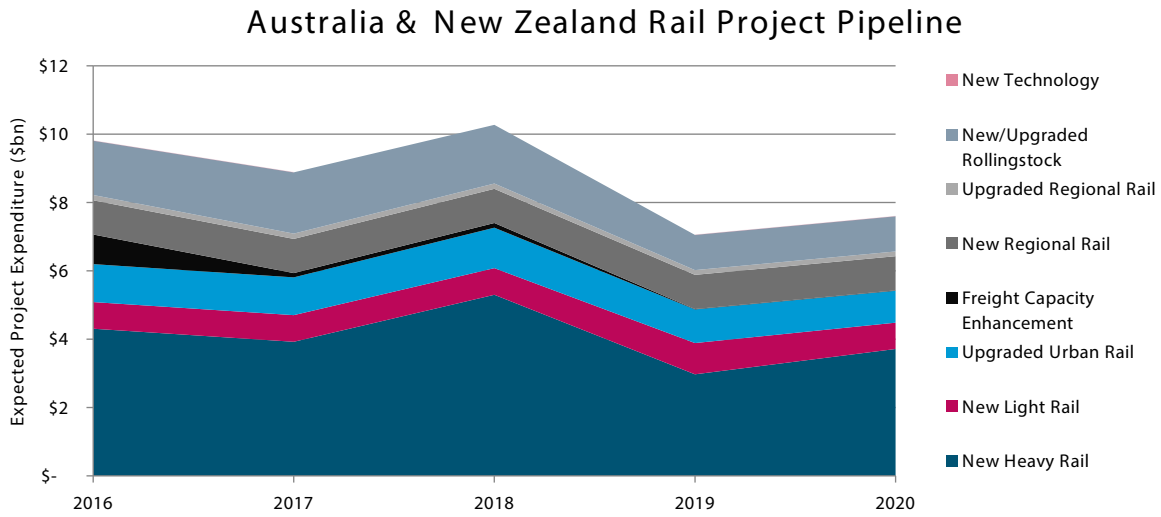


Figure 9: Australia and New Zealand rail project pipeline

Source Data: Project list, segment classifications and funding commitment status taken from ARA publication; cost estimates from various sources (where available) pro-rated against years within project period.

Supply chain and logistics

Under Medium and High economic demand scenarios, additional production for the period from 2025 to 2035 could benefit from competition associated with two rail routes to port.

Supply chain volumes

Economic modelling of the Darwin to Townsville corridor is based on the movement of inbound and outbound product from key locations along the supply chain. Overall volumes entering and exiting the corridor are illustrated in Figure 10 from 2015 to 2045.

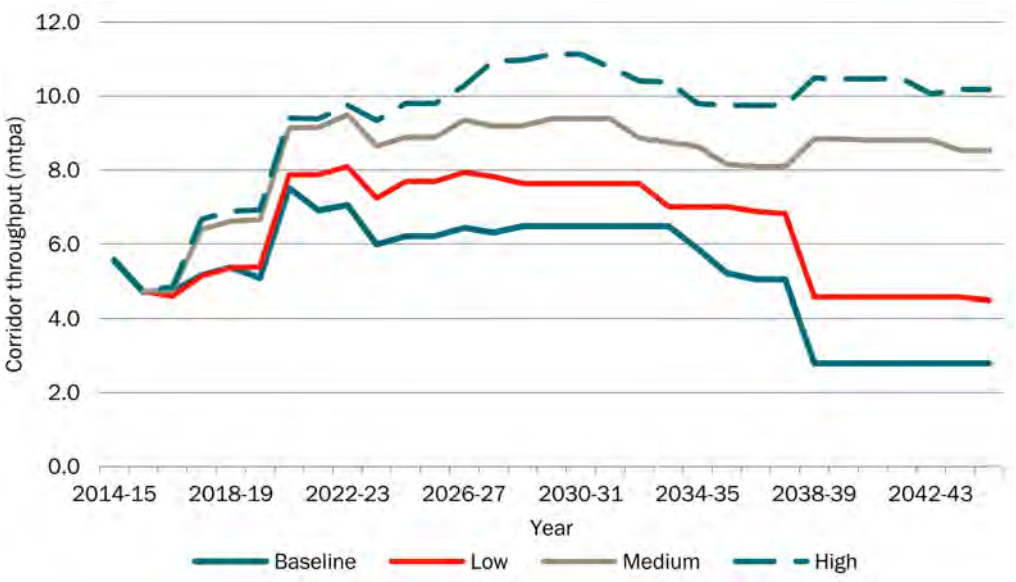


Figure 10: Forecasted total Darwin to Townsville corridor volumes under Baseline, Low, Medium and High market demand scenarios (traffic inbound and outbound to/from corridor confines)

The Darwin to Townsville corridor could evolve through three supply chain scenarios as further economic development unfolds.

These stages start with the current heavily road-dependent supply chain scenario, and move through a more efficient rail-road hub-and-spoke operation through to an eventual rail link should the economic development produce sufficient traffic. It should be noted that some economic traffic such a bulk minerals is more suitable for rail than others such as certain types of agriculture.

Figure 11: Development of the supply chain network - Darwin to Townsville corridor

As traffic volumes along the Darwin to Townsville corridor increase, the supply chain infrastructure will need to be upgraded.

The estimated capacity of major highways in the region is in the range of three to five million tonnes per annum[4] (mtpa). As the freight demand increases traffic will become heavier and road maintenance costs will increase. There will be a point where from an efficiency and cost perspective rail will need to complement road.

In this scenario there is no possibility traffic to the Port of Townsville will be redirected to Darwin.

Once the corridor reaches between 5 to 15 mtpa, there will be need for an efficient rail/road hub-and-spoke network to be in place. The hub-and-spoke network will be a scenario where generally freight from the vicinity of Mount Isa will be transported to Townsville and freight from the vicinity of Tennant Creek will be transported north to Darwin. Under this scenario there is no risk of diversion of Townsville freight to Darwin.

In this scenario it is very unlikely traffic to the Port of Townsville will be redirected to Darwin.

In the event that transport demand of more than 5 mtpa exists between Mount Isa and Tennant Creek, there may then be a need to construct the MITCR. In this scenario competition between mine-to-port routes will be created.

There may also be a case to construct the MITCR if the Darwin to Townsville corridor transports more than 15 mtpa. The reason for this would be to create redundancy in the supply chain.

In this scenario new tonnages originating from and destined to the area between Mount Isa and Tennant Creek will have the option to pass through Darwin Port or the Port of Townsville. Provided that the rail line between Mount Isa and Townsville is a competitive option, the Port of Townsville will not see a decrease of its volume throughput.

Independent of any MITCR development, Mount Isa is currently investigating the potential of establishing an intermodal hub (road/rail) to position the city as a multi-mode hub.

[4] The 3 to 5 mtpa maximum capacity calculation is based on a 50-tonne average B-double weight and a maximum acceptable frequency of one road train every 5 minutes (24 hours a day, 365 days a year).

Supply chain development

Existing infrastructure could manage forecasted corridor volumes freight volumes. However, under Medium and High demand scenarios, the additional 3 to 5 mtpa of production (from Baseline scenario, for period 2025 - 2035) could benefit from competitive transport costs associated with two rail routes to port. Additionally, mines that would otherwise not be viable may come online as a result of MITCR construction.

Increasing Australia's exposure to opportunities in Asia

A well-designed and established nation-wide freight network could improve Australia's access to developing markets in Asia.

By increasing freight competition at a national level, Australia becomes more competitive on the international stage. Increased connectivity between Australian ports and a more efficient transport network may lead to increased mining and agricultural competitiveness, sustainability and profitability. The benefits would also flow to local communities from supporting industries such as logistics and other regional and national services and operations.

Figure 12 illustrates shipping times from Asian markets to Australian ports. The MITCR could provide alternative freight routes, saving up to five days journey time between Guangzhou and Melbourne.

As Australia's freight task increases, the ports will face greater expansion constraints and increased costs. The key to avoiding further congestion in developed areas and enabling economic activity in broader Australia could be the implementation of a national freight plan which seeks to decrease transportation costs by taking a whole-of-system approach. This would require investing in the most cost-effective network arrangement from operational and capital expenditure perspectives. A freight plan should consider the specific strengths of each mode of transport mode operating in an integrated network.

"Australia will increasingly pay a high price, in terms of the competitiveness of its economy, for planning failures associated with freight corridors and precincts. Those jurisdictions that do best in this endeavour will improve the relative competitiveness of their state economies." [5]

[1] *Shipping transit times are measured from Australian ports to Guangzhou*
[2] *Source: SeaRates.com*
[3] *Source: Based on exiting passenger and freight rail services currently in operation*
[4] *Source: Estimated travel time based on average travel speed of 60km/hr*

Figure 12: Sea and rail route travel times

[5] Ports Australia 2014, p.5

MITCR infrastructure options

A number of infrastructure options exist for linking Mount Isa to Tennant Creek

Understanding the operation of an effective rail system is fundamental to the consideration of infrastructure options. Should demand require a MITCR link, a solid predictable base load of traffic should be identified to determine viability and the extent to which operating revenue will cover operating costs and recover capital investment.

The following list of infrastructure options were reviewed, from which three options, as highlighted in Figure 19, were identified as having merit for further assessment.

Option 1A: Status Quo – Do not construct

Option 1B: Tennant Creek to Wonarah (standard gauge)

Option 2A: Tennant Creek to Mount Isa (standard gauge)

Option 2B: Tennant Creek to Mount Isa to Cloncurry (dual gauge Mount Isa to Cloncurry)

Option 2C: Tennant Creek to Mount Isa to Cloncurry (dual gauge Mount Isa to Cloncurry) with Spur line to Lawn Hill

Option 3A: Tennant Creek to Mount Isa to Townsville (dual gauge Mount Isa to Townsville)

Option 3B: Tennant Creek to Mount Isa to Townsville (standard gauge Mount Isa to Townsville)

These infrastructure options were reviewed in terms of:

- Economic and other drivers for a particular option
- Wider economic impact of that option including effect on externalities
- Infrastructure requirements for that option
- Possible financing scenarios for that option.

Preferred infrastructure options

Scenario	Scope	Capital Expenditure
Option 1A	Do not construct	$0 bn
Option 2A	Construct a standard gauge link from Tennant Creek to Mount Isa	$2.70 bn (incl. 30 percent contingency)
Option 2B	Construct a standard gauge link from Tennant Creek to Mount Isa with a further dual gauge link to Cloncurry	$3.39 bn (incl. 30 percent contingency)

Table 6

Figure 13: Infrastructure options for the MITCR

Externalities

The MITCR project has a number of significant beneficial externalities that can be considered. The following externalities are difficult to quantify in economic or commercial terms:

- The construction and operation of the MITCR project would create jobs and opportunities for indigenous and regional communities in northern Australia
  - Economic benefits flowing from the land depend on factors such as location, property rights, governance arrangements of landholding bodies, and the aspirations of the Aboriginal and Torres Strait Islander landowners
  - Indigenous employment can lead to improved income for families and communities
- Rail traffic uses less fuel per tonne kilometre and, consequently, has the potential to reduce transport greenhouse gases. In the United States, LNG powered locomotives are being investigated, which create even less greenhouse gases and are cheaper to run.

Impact on stakeholders

Advisian conducted extensive stakeholder interviews in regard to the possibility of a rail link between Mount Isa and Tennant Creek. The general themes identified across these interviews were:

- A driver for competitiveness on the international stage
- A catalyst for regional economic development
- A general recognition of the value in modal shift from road to rail to achieve the most effective logistic system and reduce road maintenance costs.

Stakeholder feedback was generally very positive. However, some stakeholders questioned the viability of maintaining the MITCR when the current rail link between Mount Isa and Townsville is in need of maintenance, in part due to heritage issues.

Darwin Port is the gateway for Australia into One Belt One Road through its favourable proximity to Asian markets.

Funding challenge

The current positioning of the MITCR project is that there is too much uncertainty to create an appetite for private sector investment.

A major challenge for a project like the MITCR project is striking the balance between commercial viability and the potential for long-term economic benefit. This balance can be summarised by the two counter positions of:

- "If you build it the economic benefits will follow"
- "There must be a commercial and economic case to build the infrastructure before investment."

During the course of this study, there has been stakeholder engagement with interested parties at both ends of this spectrum. However, one view is shared by both ends of the spectrum: the greater the certainty, the greater the private sector investment interest.

Clearly the evidence of a sound case before investment is the more prudent approach. However, Advisian suggest that a number of proactive measures be taken to develop a scenario where the case for infrastructure could exist.

The current positioning of the MITCR project is that there is too much uncertainty to create an appetite for private sector investment. Some of this uncertainty relates to world commodity prices, timing of new mine commencement, likely traffic on the line, likely governance or regulatory regime, access to the corridor and length of time required to obtain some approvals.

The result of this lack of private sector investment interest is that any construction now would have to be fully, or largely, subsidised by government. To avoid this, the first step to encouraging private sector investment is to de-risk uncertainties that are within government control.

In order to realise the MITCR project, a combination of the following would be required:

- Financing by a commercial operator
- Potential gap financing from NAIF
- Funding from one or more governments to cover any gap between the capital required for construction and capital that can be supported by revenue.

The option of financing through an institutional investor is not realistic until the MITCR project is operating with proven revenue. The anticipated enterprise value of the MITCR as modelled by The CIE is illustrated in Table 7.

The challenge then is to identify a delivery option that can maximise the opportunity to access these financing sources and minimise the gap that would have to be funded by government(s) providing capital, or subsidy, in some form.

The keys to financing the MITCR project are:

- Focus on commercial operators who have high levels of interest in owning and operating the link
- Governments reduce the risks within its control and enable regional economic growth
- Potential leverage of low-interest financing options such as NAIF
- Maximise the advantages of international interest by leveraging off Australia's low sovereign risk.

Option	Infrastructure Option 2A	Infrastructure Option 2B
Current market demand: private construction and operation	Enterprise value: Nil Funding gap: $2.7 billion	Enterprise value: Nil Funding gap: $3.4 billion
Medium market demand scenario		
Private construction + capital support	Enterprise value requires: subsidy $160 m p.a.+	Enterprise value requires: subsidy $200 m p.a.+
Public construction + capital support	Enterprise Value: <$0.2 billion Funding gap: >$2.5 billion	Enterprise value: <$0.2 billion Funding gap: >$3.2 billion
Public construction and lease (either MITCR or to Townsville)	Operating lease EV: <$0.2 billion Financial lease EV: <$0.4 billion Funding gap: >$2.3 billion	Operating lease EV: <$0.2 billion Financial lease EV: <$0.4 billion Funding gap: >$3.0 billion
Public SPV builds and operates	Enterprise value: <$0.9 billion Funding gap: >$1.8 billion	Enterprise value:<$0.8 billion Funding gap: >$2.5 billion

Table 7: Potential MITCR enterprise values under medium market demand scenario

Future steps for the MITCR project

When regional economic demand supports the consideration of new infrastructure in the short to medium term, a business case should be progressed. At this time, a number of related matters should be considered:

- Assessment of legislative models to deliver suitable regulatory outcomes for the project;
- Assessment of governance vehicles for the project; and
- Assessment of innovative funding models to determine the best way to engage the private sector.

1

Policy Drivers

Key Messages

There are three key infrastructure policies aiming to enable further development in northern Australia and improve the national freight network to increase Australia's competitiveness.

- Our North, Our Future: White Paper on Developing Northern Australia (Commonwealth of Australia 2015a)
- Economic Development Framework (Northern Territory Government 2017)
- 2016 State Infrastructure Plan (Queensland Government Department of Infrastructure, Local Government and Planning 2016a & 2016b)

1.1 Key government policy documents

Numerous policy and strategy documents relate to the need to improve the supply chain and create a more attractive environment for businesses in northern Australia. These policies illustrate government positions and intent to developing northern Australia. Projects such as MITCR may be enablers to stimulating economic growth along the Darwin to Townsville corridor. A summary list of government policy documents examined is provided in Table 1.1 and a policy map is illustrated in Figure 1.1. Additional non-government documents illustrating positions of industry and business associations are also discussed in Appendix A. The key policy documents highlighted in bold are discussed in the body of this paper.

Commonwealth Government policies and strategies
• **White Paper on Developing Northern Australia**
• National Remote and Regional Transport Strategy (refer Appendix A)
• Agriculture Competitiveness White Paper (refer Appendix A)
• Australian Infrastructure Plan: Priorities and Reforms for our Nation's Future (refer Appendix A)
• Reef 2050 Long-Term Sustainability Plan (refer Appendix A)
• Overcoming Indigenous Disadvantage — Key Indicators (seventh edition) - Australian Productivity Commission (refer Appendix A)
• Infrastructure Priority List Update (refer Appendix A)
Northern Territory Government policies
• **Economic Development Framework – 2017**
• **Port Development Strategy 2014-2019 (refer Appendix A)**
• Framing the Future Strategic Plan (refer Appendix A)
Queensland Government policies
• **State Infrastructure Plan**
• Mount Isa Line Rail Infrastructure Master Plan 2012 (refer Appendix A)
• Moving Freight: A strategy for more efficient freight movement (refer Appendix A)
• Advancing North Queensland (refer Appendix A)
• Draft guideline: master planning for priority ports Queensland (refer Appendix A)

Table 1.1: Policy and strategies summary list

1.1.1 White Paper on Developing Northern Australia

The White Paper on Developing Northern Australia (Commonwealth of Australia 2015a) is the Commonwealth Government's plan for building a strong, prosperous economy in northern Australia, and providing a safe and secure country. It explores potential policies for implementation before 2035.

The White Paper includes measures to unlock the north's potential across six key areas: simpler land arrangements to support investment; developing the north's water resources; growing the north as a business, trade and investment gateway; investing in infrastructure to lower business and household costs; reducing employment barriers; and improving governance. Primary White Paper enablers are:

- Fix roads and telecommunications
- Build dams to deliver certainty to landholders and water users
- Drive down the costs of operating in the north for businesses
- Make regulations and infrastructure investments that encourage jobs and tackle the costs of living far from major cities.

Infrastructure is recognised as playing an integral role in unlocking economic opportunities. These opportunities are required particularly in northern Australia, as is recognised by the Commonwealth Government. Current projects include: :

- The $5 billion Northern Australia Infrastructure Facility, providing concessional loans for major infrastructure in the north and supporting projects prioritised on the new infrastructure pipeline.
- Investing $5 million in rail freight analyses — starting with a pre-feasibility analysis of a Mount Isa to Tennant Creek railway.

Relevance to the MITCR

The current MITCR Strategic Options Paper (this Paper) is a component of the rail freight analysis investment.

"We will drive down the costs of operating in the north for business; making it a more attractive place to invest and work. By making the right regulations and infrastructure investments, we can encourage jobs and tackle the costs of living far from major cities." – Commonwealth of Australia 2015, p.IV

1.1.2 Economic Development Framework – 2017 (discussion draft)

The Northern Territory Government Economic Development Framework (Northern Territory Government 2017) aims to build on the Northern Territory's strengths and create an economic environment that encourages and rewards innovation and is a preferred destination for new investment. It recognises that infrastructure is the foundation of economic and social development.

The document recognises that economic growth in Asia is creating new demand for a broad range of goods and services. To capitalise on this, the document adopts a strategic direction that focuses on investing in economic enablers that provide the platform for broad-based growth, and driving opportunities in the Northern Territory's most competitive industries.

The Economic Development Framework recognises the substantial potential for the discovery and development of further major mineral deposits. In relation to minerals development, the document identifies that investment may be either directly in mining ventures, or in the logistics and supply chains that are critical to the success of mining projects.

Relevance to the MITCR

Actions arising out of the Economic Development Framework include:

- Providing certainty for ongoing infrastructure investment over a 10-year horizon
- Identifying priority infrastructure in order to invest where it is most required, informed by Industry Development Strategies and Priority Development Zones.

This illustrates the Northern Territory Government's intent to support priority infrastructure projects. Although the MITCR is not currently high on the priority list, the Economic Development Framework highlights the government's investment in pre-competitive geological exploration which may increase importance of the MITCR should there be significant discoveries along the Darwin to Townsville area.

"Accelerating economic growth can be facilitated by strategic public sector investment that acts as a catalyst for private sector investment. Due to limited funding Government has to take a very strategic approach to how it assesses competing opportunities to ensure it obtains the biggest economic impact from its investment." – Northern Territory Government 2017, p.14

1.1.3 State Infrastructure Plan

"These different industry zones and the supply chains that underpin them require different infrastructure responses. For example, regions with tourism advantages require marine and aviation infrastructure, while agricultural areas and resource production need access to domestic and export markets through effective integrated supply chains." – Queensland Government Department of Infrastructure, Local Government and Planning 2016a, p.19

The Queensland State Infrastructure Plan (SIP) (Queensland Government Department of Infrastructure, Local Government and Planning 2016a) was developed to outline the strategic direction for the planning, investment and delivery of infrastructure in Queensland. It is comprised of two parts:

- **Part A: Strategy** – details the approach for infrastructure planning and prioritisation in the future
- **Part B: Program** – which provides a program of investment over four years to 2020. It also outlines future opportunities, seeking to harness from industry to provide solutions.

Relevance to the MITCR

The MITCR is not mentioned in the SIP; however, the SIP recognises the medium term (within 10 years) priority for upgrading the Mount Isa rail corridor. An Infrastructure Portfolio Office, within the Department of Infrastructure, Local Government and Planning, is to be established to plan and coordinate infrastructure, in consideration of economic and regional concerns. This office would coordinate infrastructure corridor plans for long-term transport needs for Mount Isa to Townsville.

The SIP also acknowledges the need to develop economic zones as broadly illustrated in Figure 1.2.

"These different industry zones and the supply chains that underpin them require different infrastructure responses. For example, regions with tourism advantages require marine and aviation infrastructure, while agricultural areas and resource production need access to domestic and export markets through effective integrated supply chains." – Queensland Government Department of Infrastructure, Local Government and Planning 2016a, p.19

Figure 1.1: Queensland's broad economic zones – indicative only (Queensland Government Department of Infrastructure, Local Government and Planning 2016a, p.19)

2

Economics and national competitiveness

Key Messages

Current economic trends in the Darwin to Townsville corridor are characterised by:

- Static employment numbers in the resource sector (anticipated to decline)
- Slow growth in agricultural employment (anticipated to continue growing slowly)
- Overall employment levels are decreasing.

To increase growth and sustain long-term economic activity along the Darwin to Townsville corridor, policy reform combined with the right market conditions could be a valuable enabler. Policy reform could be explored in the following areas:

- Land tenure and facilitation of native title resolution so as to enable negotiation of Indigenous Land Use Agreements (ILUA)
- Pastoral leases: increase flexibility and transferability of pastoral lands
- Environmental approval processes: clarification processes surrounding environmental Impact statement (EIS) approvals.

An effective means of addressing targeted policy reform could be the identification of high potential economic precincts in the Darwin to Townsville corridor and providing certainty to the private sector by confirming these in a corridor land use master plan.

This section of the report is in-part based on economic analyses undertaken by The CIE (refer The Centre for International Economics 2017a).

2.1 Current economics of the corridor

There is currently concern surrounding the continuation of economic growth in northern Australia. The geographical remoteness and low population density are hindrances that make development in the north difficult.

Some trends over the last four years are:

- Sugar and molasses has seen an increase of production and profitability as a result of good growing conditions.
- Cattle prices continue at historically high levels due to drought in Australia and strong demand globally.
- Mineral prices continue to decline, though recent rebounds in copper and other minerals signal improvements to come.

Figure 2.1 illustrates employment levels along the corridor. Employment is seen to be decreasing whilst unemployment is increasing at a less gradual rate, suggesting either a population exodus of the area or a decrease in participation rates.

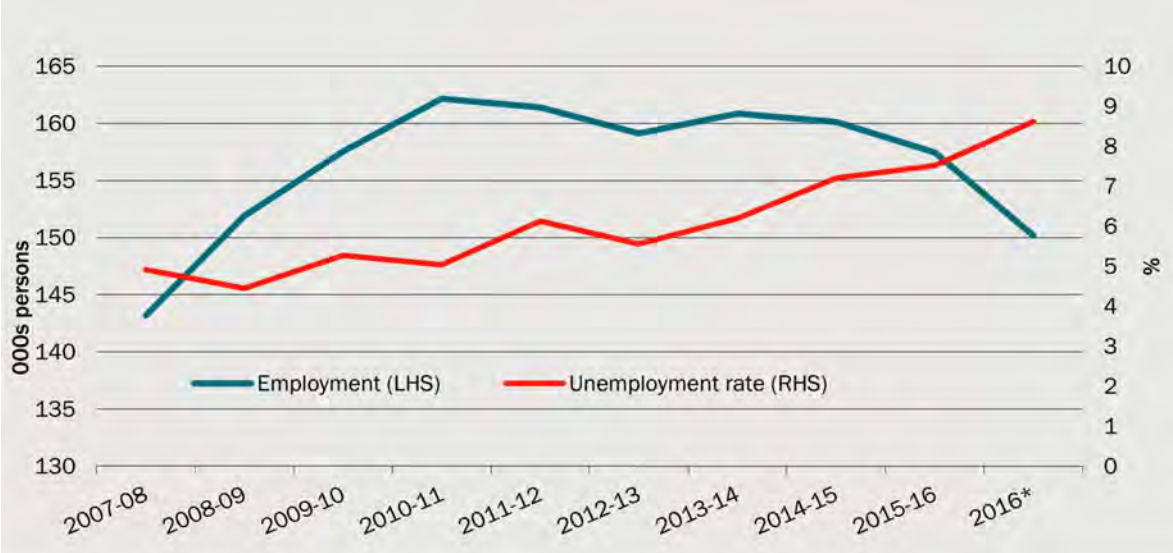


Figure 2.1: Employment and unemployment along the Darwin to Townsville supply chain corridor (The Centre for International Economics 2017a, p.14)

Note: Employment is measured as the number of positions held, not in full-time equivalents.

Data source: ABS Labour Force Australia CIE.

Employment along the corridor has fallen by approximately 16,000 (13 percent) over the past five years. Figure 2.2 shows employment in various sectors between 2010/11 and 2015/16. As seen, agriculture has witnessed a decline in employment, whilst all other sectors have had marginal decreases in employment rates with the exception of mining.

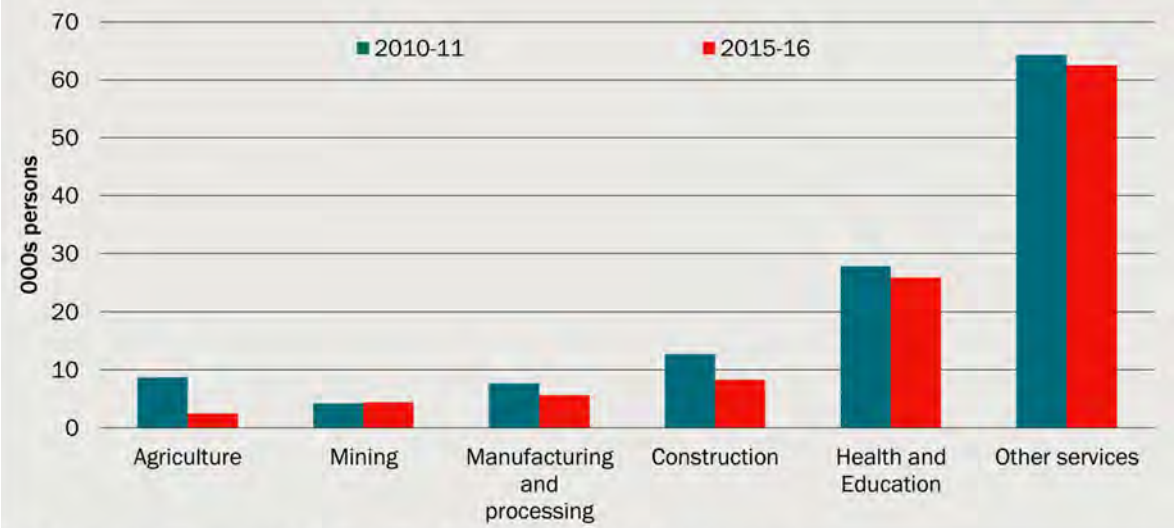


Figure 2.2: Shifts in employment along the corridor over the past five years (The Centre for International Economics 2017a, p.15)

Note: Employment is measured as the number of positions held, not in full-time equivalents.

Data source: ABS Labour Force Australia CIE.

The resource sector is important to northern Australian with approximately 5 mtpa of volume being railed across the GNR between Townsville and Mount Isa (Queensland Rail, personal communication 2016). There are also additional volumes transported across the heavily-used Barkly and Flinders Highways between inland mines and Townsville. One clear indicator of the performance of the resource sector is the volume throughputs of the Port of Townsville. In 2015/16 the Port of Townsville had a throughput of 9.2 million tonnes, a decline of 30 percent since its peak in 2011/12 when the minerals sector witnessed record prices (Port of Townsville 2016b). The decrease in throughput can be broken down to:

- A decrease in volumes exported by 17 percent (The Centre for International Economies 2017a, p.15)
- A decrease in volumes imported by 40 percent (The Centre for International Economies 2017a, p.15).

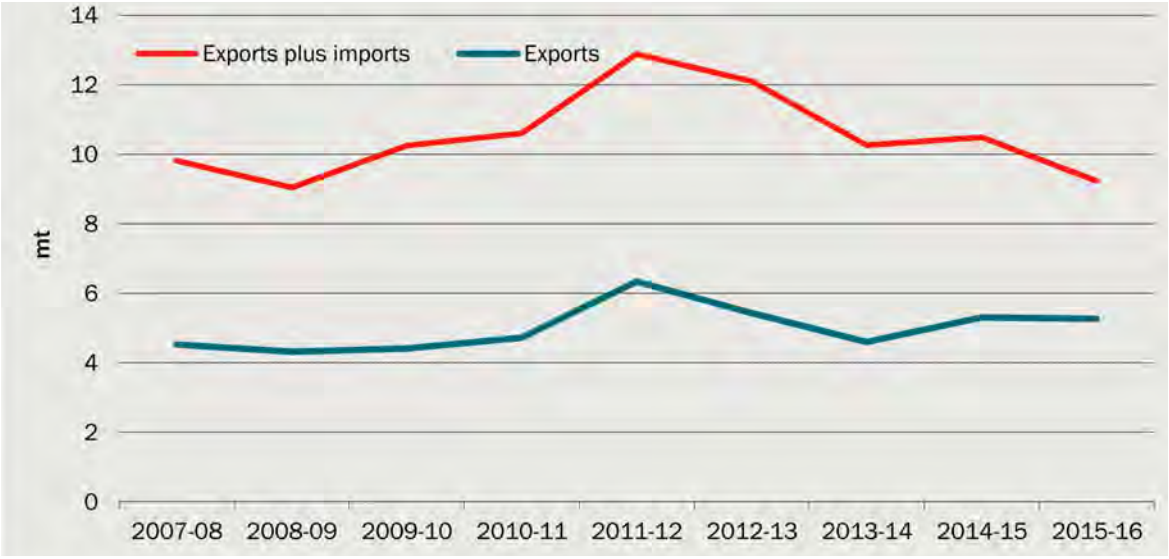


Figure 2.3: Throughput of the Port of Townsville (The Centre for International Economics 2017a, p.16)

Note: Employment is measured as the number of positions held, not in full-time equivalents.

Data source: ABS Labour Force Australia CIE.

The throughput of exported volumes through the Port of Townsville is illustrated in Figure 2.4. Most notable is the steady increase in sugar, molasses and live cattle throughput which is counteracting the decreasing throughput of ores and concentrates which may see further decline with the closure of Queensland Nickle.

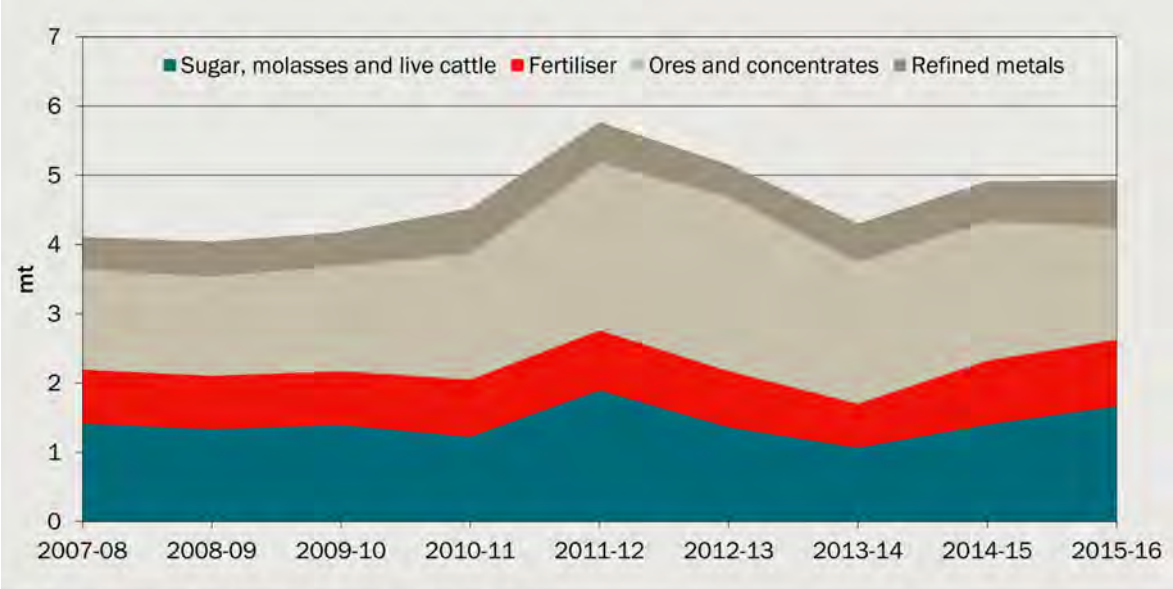


Figure 2.4: Corridor production exported through Port of Townsville (The Centre for International Economics 2017a, p.16)

Note: Excludes production from the Townsville nickel refinery.

Data source: Department of Transport and Main Roads, Trade statistics for Queensland ports and port of Townsville.

2.1.1 Resources

Mineral production has remained constant since the GFC irrespective of increases to prices. Along the Darwin to Townsville corridor mining production and employment is dominated by a small number of large firms. Entry of new firms is constrained due to infrastructure access and mining approval processes.

It is not expected that production levels will continue to remain steady; rather there is potential for them to decline. Major miners will ultimately deplete their higher-concentrate ore bodies and eventually have no remaining reserves. Incitec Pivot is expected to have sufficient deposits of phosphate rock to sustain operations until the 2040s, however the main operational constraint is sulphuric acid supply which will become a concerning factor if the Mount Isa copper smelter closes in 2022. It is reported that profitability and remaining high quality copper reserves is more likely to cause the smelter's closure than environmental requirements. Despite a decrease in quality of ore body and increased labour costs, there is the potential for the copper smelter to source alternate copper ore from other mines. (The Centre for International Economies 2017a, p.18)

Copper production

Although production of copper Australia-wide has increased since 2001/02, in Queensland it has decreased from 479,000 tonnes to 287,000 tonnes from 2001/02 to 2014/15. Figure 2.5 illustrates the production of copper metal in Australia and Queensland.

Figure 2.5: Production of copper metal at mines in '000s of tonnes (The Centre for International Economics 2017a, p.20

Note: Copper mines produce copper metal in ores and concentrates. This chart shows the volume of copper metal in ores and concentrates produced at mines.

Data source: Bureau of Resources and Energy Economics.)

As shown in Table 2.1, most of the copper production in Queensland is attributable to mines in North West Queensland in the Mount Isa and Cloncurry regions, namely Mount Isa and Ernest Henry mines.

	Owner	Region	Sub-region	Production ('000 tonnes)
Mount Isa underground copper mine	Glencore	NW Queensland	Mount Isa	163
Ernest Henry underground mine	Glencore	NW Queensland	Cloncurry	50
Eloise copper mine	FMR	NW Queensland	Cloncurry	13
Osborne	Chinova	NW Queensland	Cloncurry	25
Great Australia mine	WHSP	NW Queensland	Cloncurry	1
Cloncurry Copper project	WHSP	NW Queensland	Cloncurry	6
Lady Annie	CST	NW Queensland	Mount Isa	25
Balcooma	Snow Peak	Eastern Queensland	Charters Towers	2
Mount Carlton	Evolution mining	Eastern Queensland	Charters Towers	2
Total (reported by BREE)				**287**

Table 2.1: Production of copper metal at mines in Queensland (The Centre for International Economics 2017a, p.49)

Note: A lack of publicly available data makes it impossible to provide precise estimates of production at different mines in Queensland. This data was derived as follows. Glencore reported the production of 203 kt of copper metal in north-west Queensland from its own sources in 2014–15. A source at DNRM estimated that around 4% of copper is lost in the smelting and refining process, which implies that Glencore's mines produced 211 kt of copper metal. Company plans suggest that Ernest Henry should be producing around 50 kt of copper per year, implying that the Mount Isa underground mine produces around 163 kt of copper per year. Other data was derived using company production reports, data from DNRM and residual estimates. Washington H Soul Pattinson and Company Ltd annual reports suggest that its two mines are in 'care and maintenance', so their current production is assumed to be zero.

Estimates indicate that the average concentration of copper globally is 0.5 percent per tonne. Mount Isa and Ernest Henry mines have higher levels of concentration, 2.3 percent and 1.3 percent respectively. Higher concentration levels of copper have allowed Queensland's north western mines to incur lower-than-average extraction costs.

In Australia, copper mines tend to only be successful with ore bodies that have a higher-than-average concentration level (i.e. more than 1 percent). This is illustrated in Table 2.2.

Mine	State	Production 2014-15		Resources (most recent)		
		kt	Share (%) of Australian production	Ore (mt)	Grade (percent)	Contained metal (mt)
Mount Isa underground	QLD	163	17	66	2.3	1.5
Ernest Henry underground	QLD	50	5	87	1.2	1.0
Prominent Hill	SA	130	14	179	1.0	1.8
Olympic Dam	SA	125	13	6190	0.8	51
Degrussa underground	WA	67	7	7.8	5.7	0.4
Cobar	NSW	51	5	5.6	5.7	0.3

Table 2.2: Ownership, production and resources of key copper mines in Australia (The Centre for International Economics 2017a, p.12)

In Queensland, there are a number of un-exploited ore bodies that could potentially sustain large scale mining operations.

Copper deposit	Production 2014-15	Resources 2014		
	kt	Ore (mt)	Grade (percent)	Contained metal (mt)
Eloise	13	38	1.3	2
Osborne	25	76	1.3	6
Mt Gordon/Mammoth	0	1434	1.2	121
Mt Oxide	0	48	1.0	5
Cloncurry CU project	6	104	1.3	4
Las Mineral (Rocklands)	0	6	1.2	1

Table 2.3: Large, higher grade copper deposits in North West Queensland where production is low or nil (The Centre for International Economics 2017a, p.12)

Reasons for which Australian high-volume copper deposits above 1 percent concentration levels are not viable are likely to be:

- Poor or no access to infrastructure
- There are higher risk and costs associated with governance and regulations.

Silver, lead and zinc

The recent closure of Century mine has resulted in a decrease in Queensland's production of lead and zinc which were 47,000 tonnes and 211,000 tonnes respectively in 2015/16. The Dugald River mine may commence production in 2017/18 and is anticipated to produce 160,000 tonnes of zinc concentrate and 18,000 tonnes of lead concentrate annually. Economic demand models assume this start year and production levels at the Dugald River mine.

Table 2.4 illustrates estimated production of lead and zinc metal in Queensland by mine.

Copper deposit	Production 2014-15			Resources 2014		
	2014-15	2015-16	2016-17	2014-15	2015-16	2016-17
Century (MMG)	68	47	0	464	211	0
Cannington (South 32)	220	208	208	112	120	120
Glencore – Mount ISA	84	84	84	243	243	242.8
Glencore – George Fisher	45	17	0	129	49	0
Glencore – Lady Loretta	40	15	0	116	43	0
Other	4	0	0	8	13	0
Total (reported by BREE)	**461**	**370**	**291**	**1071**	**679**	**362**

Table 2.4: Estimated production of lead metal and zinc metal at mines in Queensland (The Centre for International Economics 2017a, p.20)

Thermal coal

The recent announcement by Adani that its Carmichael mine will be headquartered in Townsville will have a positive effect on Townsville and its surrounding area. The project will increase the Port of Townsville's throughput during the construction phase, requiring construction materials, plant and equipment. The project will create more jobs in the region.

The stimulus to Townsville and other communities along the eastern seaboard would be an economic relief during the construction period; however ongoing operations will likely see coal exported through Abbot Point coal terminal. Benefits to Townsville would be limited during the mine's operation.

The potential for thermal coal to be exported from the area between Hughenden and Charters Towers via the Port of Townsville does exist. This prospect would come from deposits in the northern Galilee Basin such as Pentland.

2.1.2 Agriculture

Cattle are the dominant activity in the agricultural sector, contributing to approximately 90 percent of the gross value of production. Since 2012, droughts have forced increased rates of de-stocking by producers, resulting in record slaughter levels over the past three years (The Centre for International Economics 2017a, pp.33-34).

Head numbers in the Barkly Tablelands and northern and southern Gulf of Queensland areas have fallen by approximately 20 percent to 30 percent from 2012 to 2016. Provided that seasonal weather conditions revert back to normal, it is expected that within five to ten years head numbers will return to pre-drought counts (The Centre for International Economics 2017a, p.17).

Over the past five years there have also been other factors in relation to the Indonesian export market that have impacted on profitability for Australian producers, in particular Northern Territory producers have suffered most from these. Namely these are:

- The 2011 ban on live export to Indonesia that resulted in additional compliance measures being introduced to the Exporter Supply Chain Assurance System.
- Indonesian changes to import policy for the cattle industry has also had a negative effect with regards to weight-based requirements and quarterly announcements of quotas on feeder cattle.
- High transport costs restrict producers' ability to transport to other south Asian markets due to requirements of live cattle to finish in feedlots or pasture based systems.

Until weather conditions normalise, it is expected that a rebound in head numbers and herd production will be delayed into the foreseeable future without operational improvements.

2.1.3 Present-day overview

The impact of global commodity prices is linked to the prosperity of the Darwin to Townsville corridor. The past 20 years the CRB Excess Return Index can be divided into three main phases:

- Pre-GFC period up to 2003: during this time, commodity prices were flat as growth in demand was matched by successive development of new resources (additional agricultural land and mining resources) accompanied by improvements in productivity in both agriculture and mining (The Centre for International Economics 2017a, p.26).
- The period including and immediately following the GFC: the period 2005 to 2009 was characterised by very strong growth in demand by emerging economies, constrained supply conditions and increased volatility in nominal prices (The Centre for International Economics 2017a, p.26).
- Current market conditions: from 2010 to the present has featured a tempering in global demand, especially from China, and supply responses by exporters resulting in commodity prices that have stabilised at levels higher that those pre-GFC (The Centre for International Economics 2017a, p.26).

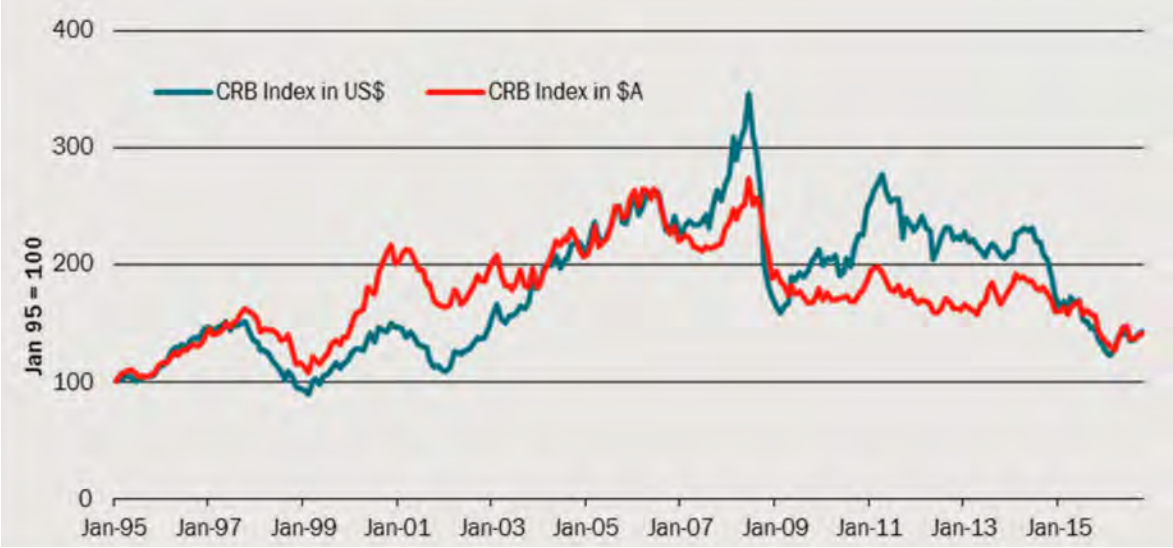


Figure 2.6: Trends in world commodity prices – CRB Excess Return Index (The Centre for International Economics 2017a, p.26)

Note: The CRB Excess Return Index is an arithmetic average of 19 commodity futures prices across petroleum products, liquid and diverse asset groupings.

Data source: http://www.investing.com/indices/thomson-reuters---jefferies-crb-historical-data

The Australian dollar is viewed as a commodity currency and therefore acts as a tempering mechanism that insulates the Australian resource sector from international volatility. To illustrate this, it can be seen that while the global commodity boom was happening immediately before the GFC, the Australian dollar was strong, reducing the capacity of exporters to increase their rate of production.

2.2 Modelling and forecasted economics of the corridor

2.2.1 Future forecasts

The modelling in this Paper bases estimates of commodity prices in period 2016 to 2025 on available forecasts that incorporate the most up to date and reliable information. Beyond 2025, commodity prices for each scenario are estimated in real terms based on the following:

- Demand prospects: commodity demand growth as a function of world economic growth (The Centre for International Economics 2017a, p.30).
- Supply-side developments: increases in agricultural land, new mineral resources and changes in productivity (The Centre for International Economics 2017a, p.30).

It must be noted that there are a large number of unknowns when forecasting prices with a 50 year horizon.

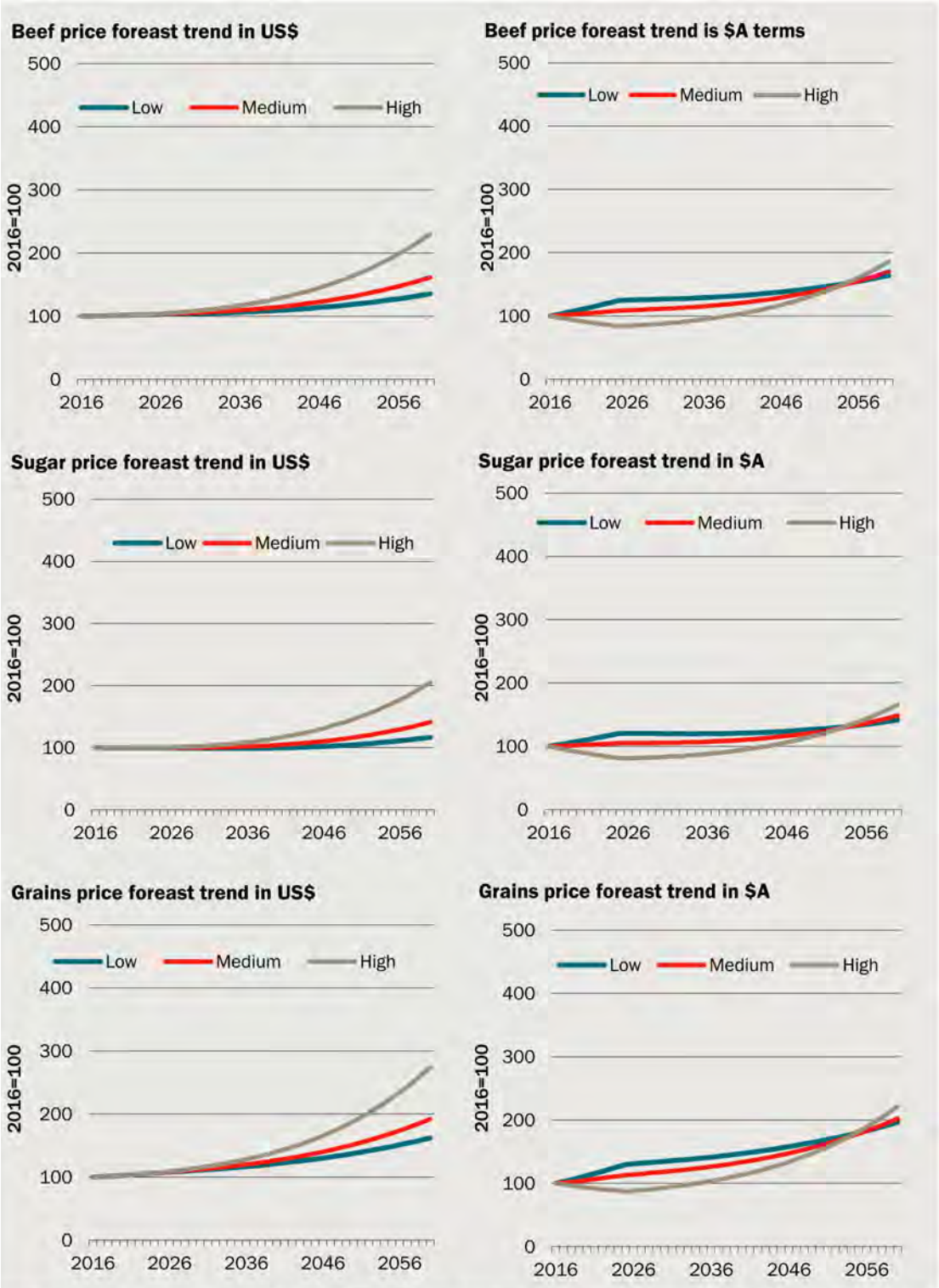


Figure 2.7: Australian dollar prices of agricultural commodities in real terms (The Centre for International Economics 2017a, p.31)

Note: Global prices in Australian dollars and real 1989-90 terms.
Data source: World Bank, ABARES, http://www.indexmundi.com and CIE calculations.

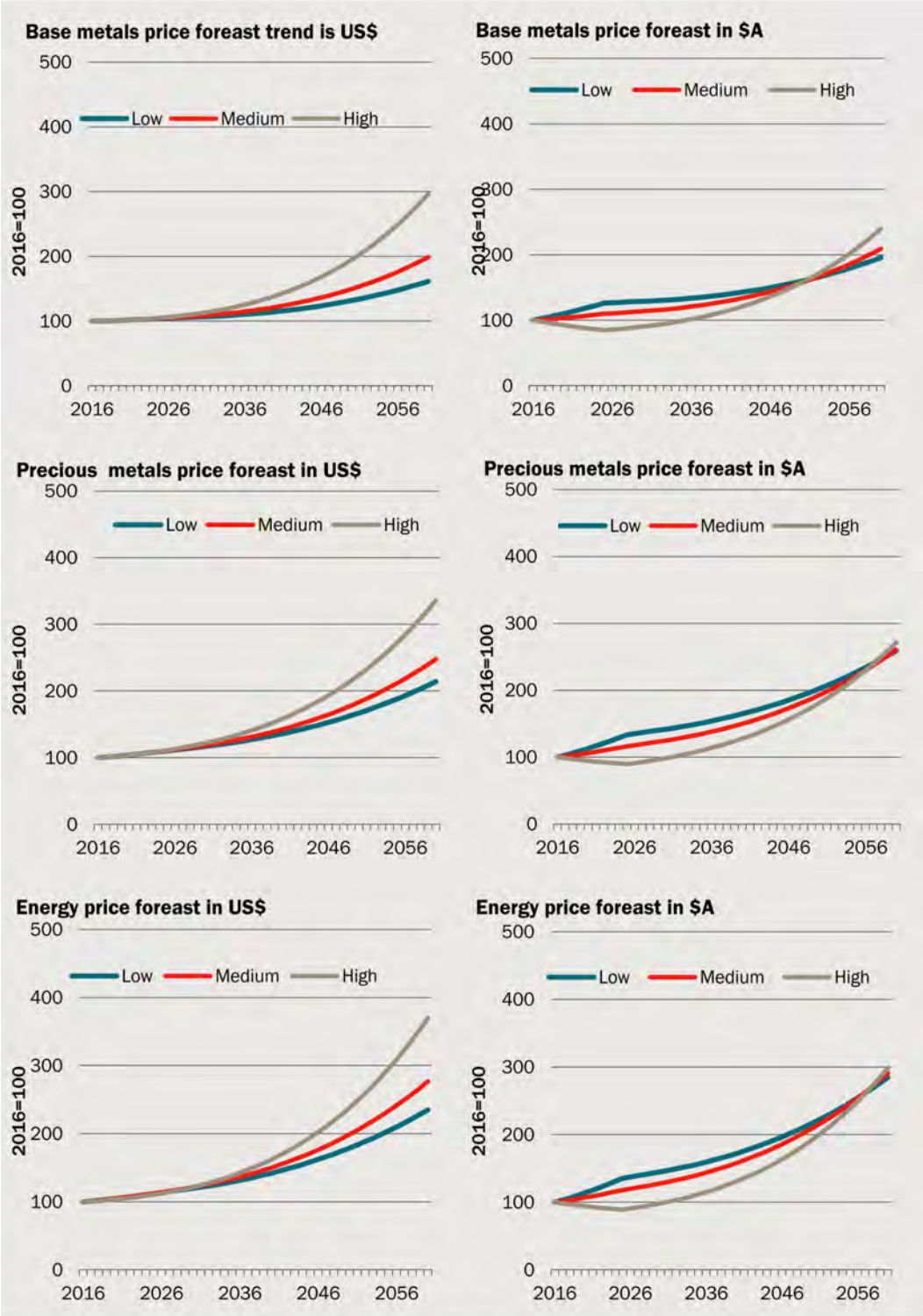


Figure 2.8: Australian dollar prices of mineral and energy commodities in real terms (The Centre for International Economics 2017a, p.32)

Note: Global prices in Australian dollars and real 1989-90 terms.
Data source: World Bank, ABARES, http://www.indexmundi.com and CIE calculations.

2.2.2 Modelling and methodology

To forecast the future potential prosperity of the Darwin to Townsville corridor, there have been five key scenarios developed. These will estimate what potential development will look like in terms of value-added and employment. All scenarios except the Baseline scenario assume that the MITCR is constructed (i.e. a standard gauge rail link between Mount Isa and Tennant creek, an intermodal terminal at Mount Isa and a dual gauge rail link between Mount Isa and Cloncurry).

These scenarios quantify economic outcomes that could reasonably be expected if:

- The investment in MITCR and economic reforms were not made – **Baseline scenario** for the analysis where industries of the corridor carry on business-as-usual with their known resources and existing capital.
- Investment in the MITCR proceeds but is not linked to the required economic reforms – the primary benefit would be an economic stimulus from a construction phase of the railway. While there would be short term benefits to economic activity and employment, outcomes would soon revert to those in the baseline. This is referred to as the **Baseline plus MITCR investment scenario**
- The investment in the MITCR proceeds and economic reforms de-risk investment along the corridor enabling them to seize opportunities in world and domestic markets through investment in new productive capacity or to improve productivity of existing systems. These outcomes would vary under three price scenarios: **Low**, **Medium** and **High**.

The resource base scenarios are illustrated in Table 2.5.

Resource scenario	Description	Major resources included
Baseline	• Current prices persist over the next 10 years, but there is no substantive policy reform • Current low-cost, high-quality operational mines, plus those mines close to commercial production, continue production • Production continues over announced mine lives from economic proven/probable reserves • Cattle industry recovers from the drought and industry productivity remains at current levels	• Resources sector continues to be dominated by large corporate players • Smaller businesses suffer declining profitability • Businesses that are not currently operational do not proceed or delay opening • Cattle stocking rates slowly recover to pre-drought levels
Baseline plus MITCR investment **(Option 2B)**	• The MITCR contributes to economic activity along the corridor through its construction, but proposed economic reforms do not occur	• Gross state product and employment benefits peak and then decline after construction • In the short term, this could offset the decline in general levels of economic activity and employment
MITCR strategy - low world prices	• Low long-term price scenario in which MITCR investment is coupled with policy reform • Current low-cost, high-quality operational mines, plus those close to production, continue production • Low-cost producers extend the announced mine lives to deplete all economic resources – Higher levels of future production become 'bankable' • Greater certainty in agriculture	• In the mining sector, the large corporate players extend the operational lives of their mines, depending on reserves – Around 15 small to medium projects are likely to become operational over the next 5–7 years • Higher productivity in the cattle sector, with the development of irrigation/cropping ventures that have already been announced
MITCR strategy medium world prices	• Medium long-term price scenario with infrastructure investment and policy reform • Medium-tier (middle-cost) mines come online – Mineral production is expanded relative to the low-price case • Measured and indicated resources are exploited before inferred resources come online	• Same profile as low-price scenario plus second-tier mines, including those with lower quality resources • Greater intensification of cattle and irrigation production than in the low-price case
MITCR strategy high world prices	• High long-term price scenario with infrastructure investment and policy reform • Lower-tier (marginal) mines come online • Highly uncertain inferred resources are exploited and additional exploration takes place	• Similar profile to medium-price scenario plus development of highest cost resources • Transformative change in the composition and intensity of agricultural and mining production

Table 2.5: Detailed description of key scenarios (The Centre for International Economics 2017a, p.23)

Note: This assessment excludes resources yet to be discovered. This limits the identifiable potential, especially under scenarios that depend on the quality of the resources.

Note: "MITCR strategy" refers to the construction of MITCR Option 2B [referred to as Option 1 plus Option 2 in The Centre for International Economics (2017a)]

The *Baseline* scenario assumes that no substantial reforms take place that enable resources to be unlocked along the corridor and business as usual continues. With this, the existing larger firms are assumed to continue normal operations and a limited number of new entrants begin production.

The Baseline scenario treats agriculture and mining and minerals process as per below.

- Mining and minerals processing: without exploration and development of new mines, the key incumbent players will operate until the end of their announced mine lives and demonstrated resources. High barriers to entry limit the potential for new entrants to commence production (The Centre for International Economics 2017a, p.24)
- Agriculture: the current structure and productivity of agriculture will persist over the medium term with productivity improvements not sufficient to cover the decline in terms of trade. For the cattle industry there will be a recovery of herd levels to pre-drought levels if there are normal rainfall seasons but there will be increasing pressure for farm businesses to become more extensive and integrated to manage ongoing climatic and price risks (The Centre for International Economics 2017a, p.24).

The *Baseline plus MITCR investment* case assumes that MITCR Option 2B is constructed without reforms. The result would be short-term benefits associated with the construction of the railway (approximately three years), however in the long term economic activity and prosperity levels are forecasted to return to baseline levels. This highlights the importance of policy reform accompanying the MITCR project development.

The remaining three scenarios – *Low, Medium* and *High* – assume varying world price levels that could result with reforms and the construction of MITCR Option 2B. Improved transport infrastructure and reforms that are more conducive toward the development of new mines along the Darwin to Townsville corridor would reduce risk to the private sector and permit long-term economic growth.

Key points pertaining to the three scenarios:

- The *Low, Medium* and *High* scenarios set out what would be possible under alternative views of demand (price) in international markets when businesses are provided with sufficient confidence that actions are underway to de-risk the investment environment along the corridor (The Centre for International Economics 2017a, p.25)
- Differences between *Low, Medium* and *High* scenarios for world prices dictate the level of production that is possible from reasonably-well known resources and the rate of return on investment in lumpy productivity capacity (The Centre for International Economics 2017a, p.25)
- Higher prices also provide the option for transformative developments within the corridor outside of the existing sectors to include new activities and products (The Centre for International Economics 2017a, p.25).

As the Australian dollar is viewed as a commodity currency. Future commodity prices for Australian exporters over the forecast period are therefore dependent on the value of futures in U.S. dollars as well the extent to which the Australian dollar correlated with a booming resource sector.

The modelling in this Paper bases estimates of commodity prices in period 2016 to 2025 on available forecasts that incorporate the most up to date and reliable information. Beyond 2025, commodity prices for each scenario are estimated in real terms based on the following:

- Demand prospects: growth in demand for commodities is a function of world economic growth as reflected by global GDP (The Centre for International Economics 2017a, p.30)
- Supply-side developments: increases in agricultural land, new mineral resources and improved productivity (The Centre for International Economics 2017a, p.30).

Assumptions of Low, Medium and High scenarios

The **Low scenario** assumes the continuation of global commodity prices to be those of pre-GFC periods. In real terms this implies a flat or downward trend in prices.

- Economic growth in Asia moderates as China and India slow to 5.5 percent and 6.3 percent GDP growth per year by 2030 compared to the 8.8 percent and 7.0 percent for the period 2008-15. World economic growth averages 3.3 percent annually from 2020 onwards (The Centre for International Economics 2017a, p.30)
- Improved access to resources and investment in energy and mining capacity continues to relax supply-side constraints on production growth (The Centre for International Economics 2017a, p.30)
- The long term exchange rate is assumed to settle around USD$0.60 to AUD$1.00 (The Centre for International Economics 2017a, p.30).

The **Medium scenario** assumes that the global commodity prices will stabilise above those of pre GFC periods.

- China and India experience moderate rates of economic growth (5.8 percent and 7.8 percent each year by 2030). World economic growth averages 3.5 percent annually from 2020 onwards (The Centre for International Economics 2017a, p.30)
- Productivity improvements do not reduce all costs associated with accessing new resources. The cost of specialist labour is retained (The Centre for International Economics 2017a, p.30)
- The long term exchange rate is assumed to settle around USD$0.70 to AUD$1.00 (The Centre for International Economics 2017a, p.30).

The **High scenario** assumes that price levels climb to those experienced during and immediately after the GFC.

- World economic growth averages 4.3 percent annual from 2020 onwards. China and India experience high rates of economic growth close those achieved during the GFC (7.6 percent and 8.5 percent each year by 2030 (The Centre for International Economics 2017a, p.30)
- Sustained increased in demand for food, energy and resources from the emerging economies will continue to grow faster than production and so drive increases in prices over the next 50 years (The Centre for International Economics 2017a, p.30)
- For this scenario, the Australian dollar is assumed to be USD$0.80 (The Centre for International Economics 2017a, p.30).

Scenario	Economic growth in key Asian markets	Average world economic growth from 2020 onwards	Exchange rate
Low	China at 5.5% by 2030 India at 6.3% by 2030	3.3%	AU$1.00 to US$0.60
Medium	China at 5.8% by 2030 India at 7.8% by 2030	3.5%	AU$1.00 to US$0.70
High	China at 7.6% by 2030 India at 8.5% by 2030	4.3%	AU$1.00 to US$0.80

Table 2.6: Summary table of economic demand scenario assumptions

2.2.3 Potential economic development with MITCR progression

The key sectors currently sustaining the Darwin to Townsville supply chain corridor are agriculture, mining and mineral processing. These two sectors are the foundation for north-west Queensland and without them population of the area would be significantly less. As such, economy-wide modelling will attempt to quantify the potential of these sectors based on existing factual knowledge as well as trends and intentions cited by the private sector.

Sector: resources

Historically, North West Queensland has been mineral-rich and mined since the early 1900s. Now, and for the foreseeable future, the main minerals by measure of volume that are likely to be exported are copper, phosphate, and zinc.

The Northern Territory side, in particular the Barkly Tablelands, are relatively unexplored and currently it is not known what mineral potential there is in this area. The largest known potential development in this area is the Wonarah phosphate deposit, located approximately 250 kilometres east of Tennant Creek. In addition, there is oil and gas exploration underway that may have potential.

A key element required to make a more informed decision regarding the potential progression of the MITCR is the current drilling program that is currently underway. A better understanding of the geology between Mount Isa and Tennant Creek will de-risk the MITCR in the eyes of both the public and private sectors.

Copper deposits in north-west Queensland

Copper is the foundation industry in the North West Minerals Province and is likely to continue despite structural changes within the resource base. The following three tables – grouped by cost to extract materials – provides an indication of what potential development the resources sector could realise given a more conducive environment.

Deposit	Currently operating?	Remaining metal ('000 tonnes)	Grade (%)	Potential production ('000 tonnes/year)	Start	Output	Location
Measured & indicated resources							
Mount Isa U/G	Y	1911	2.3	163	2016	CUA_ISA	ISA
Mount Isa O/P	Y	1783	1.4	78	2027	CUA_ISA	ISA
Ernest Henry U/G	Y	1014	1.3	50	2016	CUA_ISA	CLC
Eloise	Y	90	2.6	13	2016	CUC_CLC	CLC
Inferred resources							
Mount Isa U/G	N	127	1.7	6	2028	CUA_ISA	ISA
Mt Norma	N	64	4.0	3	2060	CUC_CLC	CLC
Rebound	N	56	7.7	2	2060	CUC_CLC	CLC

Table 2.7: Copper deposits that support low cost mines (The Centre for International Economics 2017a, pp.118-119)

Source: QNRM; company documents

Deposit	Currently operating?	Remaining metal ('000 tonnes)	Grade (%)	Potential production ('000 tonnes/year)	Start	Output	Location
Measured & indicated resources							
Mt Gordon	N	920	1.4	40	2027	CUA_ISA	ISA
Osborne	Y	176	1.4	25	2016	CUA_ISA	CLC
Mt Oxide	N	178	1.6	8	2018	CUA_ISA	ISA
CLC CU	N	47	1.5	2	2034	CUC_CLC	CLC
Inferred resources							
Mt Gordon	N	1434	1.2	62	2049	CUA_ISA	ISA
CLC CU	N	104	1.3	5	2057	CUC_CLC	CLC
Osborne	N	76	1.3	3	2023	CUA_ISA	CLC
Las Minerale	N	6	1.2	0	2050	CUC_CLC	CLC
Eloise	N	38	1.3	2	2023	CUC_CLC	CLC

Table 2.8: Copper deposits that support medium cost mines (The Centre for International Economics 2017a, pp.119).

Source: QNRM; company documents

QNRM Deposit	Currently operating?	Remaining metal ('000 tonnes)	Grade (%)	Potential production ('000 tonnes/year)	Start	Output	Location
Measured & indicated resources							
Rosebery	N	3717	0.6	162	2028	CUA_ISA	CLC
Mt Elliot	N	1091	0.5	47	2028	CUC_ISA	ISA
Lady Annie	Y	427	0.7	25	2016	CUC_ISA	ISA
Merlin		469	0.6	20	2055	CUC_CLC	CLC
Las Minerale	N	308	1.0	13	2027	CUC_CLC	CLC
White range	N	244	0.8	11	2046	CUC_CLC	CLC
Mt Margaret	N	105	0.8	5	2048	CUC_ISA	ISA
Kalman	N	92	0.4	4	2050	CUC_CLC	CLC
Starra line	N	90	0.9	4	2044	CUC_CLC	CLC
Mt Watson	N	70	0.9	3	2042	CUC_ISA	ISA
Ernest Henry U/G	N	98	1.1	4	2036	CUA_ISA	CLC
Lady Annie	N	105	0.6	5	2033	CUC_ISA	ISA
Merlin	N	319	0.3	14	2078	CUC_CLC	CLC
Mt Margaret	N	6	0.8	0	2071	CUC_ISA	ISA
Mt Watson	N	17	0.8	1	2065	CUC_ISA	ISA
Mt Elliot	N	1418	0.4	62	2051	CUC_ISA	ISA
Starra line	N	35	1.0	2	2067	CUC_CLC	CLC
Mt Oxide	N	48	1.0	2	2041	CUA_ISA	ISA
Hero	N	100	0.3	4	2060	CUC_ISA	ISA
Kalman	N	72	0.9	3	2073	CUC_CLC	CLC
Mount Isa O/C	N	1228	0.9	53	2050	CUA_ISA	ISA

Table 2.9: Copper deposits that support high cost mines (The Centre for International Economics 2017a, pp.113-119-120).

Source: QNRM; company documents

Silver, lead and zinc deposits in North West Queensland

Table 2.10 summarises the estimated reserves and end production dates of prospective silver, lead and zinc in North West Queensland.

Mine	Main metal	Production 2014/15	Base case	Reserves	Start	End	Notes
Cannington	Lead	220	197	1197	2015-16	2020-21	Exhausts reserves
Glencore: Mount Isa & George Fisher	Zinc	372	84	1197	2015-16	2034-35	Exhausts reserves
Dugald river	Zinc	0	152	1197	2017-18	2035-36	Exhausts reserves
Lady Loretta	Zinc	116	0	-	-	-	Remains closed
Century	Zinc	464	0	-	-	-	Closed

Table 2.10: Silver, lead and zinc production in baseline (The Centre for International Economics 2017a, p.53).

Model results of future silver, lead and zinc production in North West Queensland are illustrated in Table 2.11.

Deposit	Owner	Primary metal	Resources		Production by scenario			Start date	Location
			Grade (%)	Contained metal ('000 tonnes)	Low ('000/ year)	Medium ('000/ year)	High ('000/ year)		
Measured and indicated resources									
Cannington	South32	Lead	5	3 579	197	208	218	2015 – 16	Cloncurry
Mount Isa	Glencore	Zinc	5	21 535	243	372	391	2015 – 16	Mount Isa
Lady Loretta	Glencore	Zinc	16	2 098	0	116	121	2017 – 18	Mount Isa
Century	MMG	Zinc	9	855	0	18	19	2015	Cloncurry
Dugald River	MMG	Zinc	14	4 225	152	160	168	2019 – 20	Cloncurry
Pegmont	–	Lead	3	54	0	0	2	2024 – 25	Cloncurry
Walford Creek	–		0	0	0	0	0	–	Mount Isa
Altia	–		0	0	0	0	0	–	Cloncurry
Inferred resources -									
Cannington	South32	Lead	4	236	0	8	9	2032 – 33	Cloncurry
Mount Isa	Glencore	Zinc	4	10 975	0	227	239	2076 – 77	Mount Isa
Lady Loretta	Glencore	Zinc	13	195	0	4	4	2034 – 35	Mount Isa
Century	MMG	Lead	11	345	0	12	13	2054 – 55	Cloncurry
Dugald River	MMG	Zinc	13	3 196	63	66	70	2043 – 44	Cloncurry
Pegmont	–	Lead	4	253	0	9	9	2053 – 54	Cloncurry
Walford Creek	–	Zinc	2	137	0	0	3	2029 – 30	Mount Isa
Altia	–	Lead	4	229	0	8	8	2024 – 25	Cloncurry

Table 2.11: Resources and potential production for silver, lead and zinc mining by scenario (The Centre for International Economics 2017a, p.125)

Results: Estimated resource volumes extracted

The estimated quantities of resource production and industrial processing in the MITCR corridor is illustrated in Tables 2.12 to 2.15 for each of the economic scenarios modelled. Additional information about mines in this data set can be found in The Centre for International Economics (2017a).

Year	**Phosphate rock** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	2436	2436	2436	2436
2015-16	2336	2336	2336	2336
2016-17	2686	2686	2686	2686
2017-18	2727	2727	2727	2727
2018-19	2877	2877	2877	2877
2019-20	2877	2877	2877	2877
2029-30	14277	14277	15569	17169
2039-40	7277	7277	15569	17169
2049-50	5000	5000	15569	16569
2059-60	5000	6000	16569	16569

Year	**Copper ore** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	283	283	283	283
2015-16	260	260	260	260
2016-17	260	214	251	290
2017-18	226	214	259	298
2018-19	213	214	259	298
2019-20	133	214	259	298
2029-30	0	126	186	455
2039-40	0	79	138	382
2049-50	0	79	141	228
2059-60	0	5	77	257

Year	**Lead ore** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	457	457	457	457
2015-16	371	371	371	371
2016-17	292	292	292	292
2017-18	298	298	394	414
2018-19	298	298	394	414
2019-20	298	298	398	418
2029-30	101	298	406	430
2039-40	0	101	168	180
2049-50	0	93	159	171
2059-60	0	93	160	174

Year	**Zinc ore** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	1063	1063	1063	1063
2015-16	665	665	665	665
2016-17	362	362	362	362
2017-18	508	508	767	806
2018-19	508	508	767	806
2019-20	508	508	785	824
2029-30	395	508	786	829
2039-40	0	395	560	591
2049-50	0	306	466	493
2059-60	0	306	455	482

Table 2.12: Primary production in project corridor – Extraction from mines by resource and scenario (Source: The Centre for International Economics)

Year	**Direct shipped ore** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	0	0	0	0
2015-16	0	0	0	0
2016-17	300	300	300	300
2017-18	450	450	450	450
2018-19	600	600	600	600
2019-20	600	600	600	600
2029-30	2000	2000	2000	2000
2039-40	0	0	0	0
2049-50	0	0	0	0
2059-60	0	0	0	0

Year	**Phosphoric acid** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	0	0	0	0
2015-16	0	0	0	0
2016-17	0	0	0	0
2017-18	0	0	0	0
2018-19	0	0	0	0
2019-20	0	0	0	0
2029-30	1000	1000	1200	1400
2039-40	1000	1000	1200	1400
2049-50	1000	1000	1200	1400
2059-60	1000	1000	1200	1400

Year	**Fertiliser** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	1043	1043	1043	1043
2015-16	1000	1000	1000	1000
2016-17	1022	1022	1022	1022
2017-18	975	975	975	975
2018-19	975	975	975	975
2019-20	975	975	975	975
2029-30	975	975	1100	1357
2039-40	975	975	2300	2557
2049-50	0	0	2300	2300
2059-60	0	0	2300	2300

Table 2.13: Industrial production in project corridor (output that will be shipped) – Industrial output related to phosphate (Source: The Centre for International Economics)

Year	Copper anode *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	219	219	219	219
2015-16	219	219	219	219
2016-17	230	186	219	230
2017-18	238	186	226	238
2018-19	238	186	226	238
2019-20	238	186	226	238
2029-30	335	117	170	335
2039-40	285	73	124	285
2049-50	118	73	128	118
2059-60	114	0	57	114

Year	Copper cathode *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	25	25	25	25
2015-16	9	9	9	9
2016-17	0	0	0	0
2017-18	0	0	0	0
2018-19	0	0	0	0
2019-20	0	0	0	0
2029-30	0	0	0	0
2039-40	0	0	0	0
2049-50	0	0	0	0
2059-60	0	0	0	0

Year	Copper concentrate *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	78	78	78	78
2015-16	50	50	50	50
2016-17	50	47	50	152
2017-18	50	47	50	152
2018-19	0	47	50	152
2019-20	0	47	50	152
2029-30	0	0	6	350
2039-40	0	0	14	277
2049-50	0	0	9	379
2059-60	0	19	55	509

Year	Sulphuric acid (Isa smelter) *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	1000	1000	1000	1000
2015-16	1000	1000	1000	1000
2016-17	1000	849	1000	1050
2017-18	894	849	1032	1084
2018-19	894	849	1032	1084
2019-20	559	849	1032	1084
2029-30	0	531	774	1526
2039-40	0	332	563	1299
2049-50	0	332	583	539
2059-60	0	0	262	520

Table 2.14: Industrial output related to copper mining: kt/year (Source: The Centre for International Economics 2017)

Year	**Lead bullion** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	168	168	168	168
2015-16	116	116	116	116
2016-17	84	84	84	84
2017-18	84	84	168	177
2018-19	84	84	168	177
2019-20	84	84	168	177
2029-30	84	84	168	177
2039-40	0	84	130	137
2049-50	0	84	130	137
2059-60	0	84	130	137

Year	**Lead concentrate** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	414	414	414	414
2015-16	368	368	368	368
2016-17	306	306	306	306
2017-18	313	313	329	346
2018-19	313	313	329	346
2019-20	313	313	334	351
2029-30	23	313	344	367
2039-40	0	23	51	59
2049-50	0	12	40	47
2059-60	0	12	41	50

Year	**Zinc concentrate** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	2695	2695	2695	2695
2015-16	1714	1714	1714	1714
2016-17	992	992	992	992
2017-18	1298	1298	2074	2178
2018-19	1298	1298	2074	2178
2019-20	1298	1298	2112	2217
2029-30	1059	1298	2114	2230
2039-40	0	1059	1532	1619
2049-50	0	872	1335	1412
2059-60	0	872	1313	1389

Year	**Sulphuric acid (Townsville)** *('000s tonnes)*			
	Baseline	Low	Med	High
2014-15	559	559	559	559
2015-16	350	350	350	350
2016-17	191	191	191	191
2017-18	268	268	404	424
2018-19	268	268	404	424
2019-20	268	268	413	434
2029-30	208	268	414	436
2039-40	0	208	294	311
2049-50	0	161	245	259
2059-60	0	161	239	253

Table 2.15: Industrial output related to copper mining: kt/year (Source: The Centre for International Economics 2017)

Sector: Agriculture

Beef industry

The beef industry contributes to over 90 percent of the agricultural industry in the Darwin to Townsville corridor. Due to the remote nature and variable climatic conditions of non-costal agriculture in northern Australia, it is regarded as a high-risk sector.

Table 2.16 is taken from the Queensland Agricultural Land Audit and summarises the potential for agricultural land use in three key areas.

	Gulf		North West		Qld corridor	
	Current (000s ha)	Potential[a] (000s ha)	Current (000s ha)	Potential[a] (000s ha)	Current (000s ha)	Potential[a] (000s ha)
Broadacre cropping	2	1 091	1	1	3	1 092
Sugar cane	0	2 441	0	0	0	2 441
Perennial agriculture	0	756	0	391	0	1 148
Annual horticulture	0	2 390	0	1 792	0	4,182
Unimproved pastures	16 232	12 633	19 536	19 065	35 768	31 698
Improved pastures	438	2 809	55	346	494	3 158
Intensive livestock	1	2 663	1	1 781	1	4 444
Aquaculture	0	318	0	0	0	318
Other	1 059		3 990		1 458	
Total	17 731		19 992		37 724	

Table 2.16: Current and potential land use, Queensland segment of Darwin to Townsville corridor (The Centre for International Economics 2017a, p.34)

[a] This is the area of land that could be suitable for multiple purposes

Source: Queensland Agricultural Land Audit

Approximately 96 percent of the land in the Queensland segment of the Darwin to Townsville corridor is used for cattle grazing. On the Northern Territory side it is expected that there would be a similar percentage of land used for grazing in the Barkly Tablelands area. There are two broad categories of cattle businesses that currently exist; larger corporate-owned stations and smaller businesses. The larger corporate-owned stations have their own integrated supply chains, managing operations from feedlots to processing and marketing.

These larger businesses manage their risk through diversification, scale of operations, and are known for having increasing levels of foreign ownership.

Transportation costs of cattle in the Mount Isa/Cloncurry and Barkly Tablelands areas are illustrated in Table 2.17. Transportation costs can equate up to 38% of the saleyard price.

	Mount Isa / Cloncurry			Barkly Tablelands		
Market	**2009–14**	**2014–15**	**2015–16**	**2009–14**	**2014–15**	**2015–16**
Feeders 300 kg live weight (%)						
Darwin live trade	21	17	15	21	15	13
Roma saleyards	21	18	13	28	24	17
Cows 400 kg live weight (%)						
Darwin plant	22	21	13	19	18	12
Roma saleyards	23	18	13	31	25	18
Brisbane over-the-hooks	24	23	15	38	36	23

Table 2.17: Cattle road transport costs as percentage of saleyard price (The Centre for International Economics 2017a, p.35)

Note: Based on the case of a Type 1 truck with four decks.

Source: CSIRO Transit model and the CIE

Under different price scenarios the number of turnoff head per year is illustrated in Figure 2.9 with the resumption of normal seasonal weather patterns.

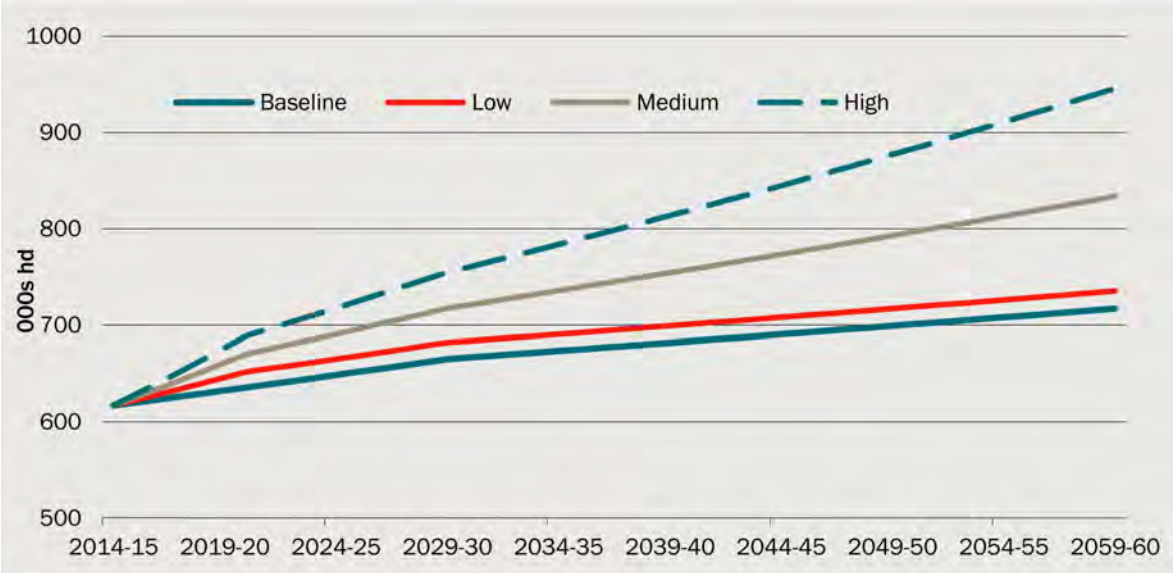


Figure 2.9: Turnoff of cattle along the Townsville to Darwin corridor – 2015 to 2060 (The Centre for International Economics 2017a, p.40)

Note: Based on a baseline turnoff of 784,000 head, estimated from ABARES surveys.

Source: ABARES and The CIE

Smaller businesses in the beef industry are exposed to more risk and have fewer options regarding routes to market. In Queensland, the smaller firms in the beef industry have been noted to be more dependent on drought support programs.

To improve productivity and profitability in the beef industry, there are three key areas to address:

1. Addressing current industry constraints
2. Improving market options
3. Intensifying production systems

Intensified agriculture

The North West Queensland Strategic Development Study identified that the development of intensified agriculture as a priority. Three key findings of this study that are critical to the development of agriculture in northern Australia are:

- Development of water resources and allocation of water titles
- Ability to subdivide land
- Provision of adequate transport infrastructure.

Table 2.18 illustrates the strengths and weaknesses of developing intensified agriculture in northern Australia.

Strengths	Weaknesses
• The huge expanse of undeveloped land currently focused on grazing: – Different land and soil types provide multiple grazing and management options, and; – Scope for broadacre agriculture and horticulture. • Well-established supply chain for cattle: – Live exports through Karumba, Townsville, and Darwin – Also sold through Roma, Charters Towers or 'direct' to Townsville, Rockhampton and Brisbane. • There is reliable road access to the major centres of Townsville, Darwin, Melbourne and Sydney during autumn, winter and spring • Favourable weather conditions for cotton growers • Scope for annual and perennial horticulture – Early season production of some horticultural crops favour niche market opportunities, such as production of early season fruit (mangos) and vegetables for southern markets. • Scope to intensify cattle production through: – Increased input use and pasture improvement – Improving pasture utilisation through investment in fencing and watering points – Improved management of herd health and fertility • Potential for irrigation development and release of water entitlements in the Flinders and Gilbert catchments: – Scope for intensification of production over time, evolving from broadacre crops to horticulture	• Highly variable climate with extremes in temperature, rainfall and evaporation rates. There is also susceptibility to bush fire, floods and cyclones • Long distances to markets lead to increased freight costs and higher potential for spoilage: – Roads can be closed during wet season and capacity is limited to some markets – Undeveloped cold chain infrastructure • Difficulties in attracting and retaining skilled and unskilled workers and residents • Constraints on production include: – Weeds – calotrope, bellyache bush, rubber vine and woody weeds – Insects – fruit fly, banana pests and vegetable leaf-miner in the Gulf and rusts, smuts and thrips in the North West are also a problem – Animal health – phosphorus deficiencies and infertility, arthropod-borne diseases, cattle ticks and botulism • Extremes in wet and dry conditions in combination with low or no fertiliser use and weeds have combined to reduce pasture productivity • Water resources are highly variable: – Groundwater quality is variable – Bores can be expensive – Capture and storage of stream/overland flows requires infrastructure approval and licensing – Flat topography limits scope for dam/weirs and increases evaporation losses

Table 2.18: Overview of agricultural strengths and weaknesses along the corridor (The Centre for International Economics 2017a, p.42)
Note: This table focuses mainly on the Gulf and north-west of Queensland but is also applicable to the Barkly Tableland.
Source: Adapted from Queensland Agricultural Land Audit

There are currently two major projects that have the capacity to improve performance and resilience of agriculture along the Darwin to Townsville corridor. The production of sorghum for grain or fodder could provide the sector with the options of strategic feeding programs to target key markets and weight specifications throughout the year, rather than around traditional turnoff times during narrow market windows.

Current opportunities that could be captured through investment in water

In July 2012 the Queensland Government announced the release of 80,000 and 15,000 megalitres of water reserved for new irrigation developments in the Flinders and Gilbert Catchments.

The Three Rivers Irrigation Project to provide for cotton farming

Stanbroke Pty Ltd is the proponent for the Three Rivers Irrigation Project to supply its Glenore property in the Lower Flinders catchment. The proposed project is a 15,000 hectare cotton farm and associated ginnery and aims to produce cotton for the export market and utilise the cotton seed by-product as supplementary feed for beef cattle in the dry season (which is normally imported from central and southern Queensland). The project will require a water allocation of approximately 150,000 megalitres, or 122,000 megalitres more than its current water allocation.

Current plans indicate that cotton would be exported through the Port of Karumba. The capital cost of the project is estimated at more than $200 million. The project is scheduled for construction between 2016 and 2018 and to be operational in 2019. It would provide up to 100 on-site jobs in the construction phase and up to 75 in the operations phase at peak production. The workforce will vary seasonally.

Other scope to increase value added in the Flinders and Gilbert catchments

The proposed developments higher in the Flinders River catchment towards Cloncurry and Julia Creek are largely dependent on release of 239,000 megalitres of unallocated water which has been announced as being tradable.

AACo is a leading proponent in the Flinders Catchment securing 19,200 megalitres for Dalgonally station in the 2013 water release. It has also stated that it won't be planting on its properties until further water is released.

The Integrated Food Energy Development has options over land to grow 50,000 hectares of sugar cane in the existing Gilbert River Farming District. In total, the project area comprises:

- Five properties over 326,000 hectares with 65,000 hectares of cropping
- 18,000 hectares of water storage and 241,000 hectares of grazing.

Total project investments were estimated to be almost $2 billion with an annual revenue of nearly $900 million from the production of raw sugar, ethanol and co-products including stockfeeds.

Realising economic potential via investment in water (The Centre for International Economics 2017a, p.44)

Source: http://www.northqueenslandregister.com.au/story/3597756/flinders-river-investors-urged-to-look-at-history-photos/ and Presentation ABARES Outlook to Keith De Lacy Chairman, Integrated Food and Energy developments Pty Ltd 2014

Intensified agriculture is hindered by inflexible pastoral lease arrangements. The Commonwealth Government's White Paper (2015, p.34) acknowledges this.

"Today, while some jurisdictions have more flexible arrangements than others, pastoral leaseholders often face a number of challenges.

- *Lease arrangements can restrict leaseholders from using their land for activities other than grazing.*
- *The expansion of activities in to horticulture or tourism may require additional approvals from government.*
- *Approvals for additional activities may not be registrable on title and therefore may not be transferable.*
- *Leasehold does not have the same security as freehold, which can mean business is less likely to invest in infrastructure.*
- *Potential investors can face unfamiliar and complicated regulations, compared with those surrounding less restrictive forms of tenure."*

As noted by the CIE, pastoral leases are another barrier for small businesses to pursue opportunities in intensified agriculture and other industries.

"*The proponents of current project proposals are corporates that operate or would operate as part of large and integrated operations that include extensive grazing. Currently, it is only businesses of this scale who have access to suitable land and are positioned to make the scale of the investment required such as the development of earthworks associated with off-river storages, ditches and laser-levelling. Therefore, more intensive agriculture is currently only an option for large landholders who have the capacity to invest.*" (The Centre for International Economics 2017a, p.45)

"*Under current leasehold arrangements, capability to sub-divide, improve and sell-off any improved land is subject to approval by the Minister and is also likely to trigger other regulatory processes. These factors remain a significant impediment to more intensive agriculture based on large and small-scale irrigation.*" (The Centre for International Economics 2017a, p.45)

"*A vision for transformation into horticulture would involve transition from largely bulk and durable products (for example, cattle and cotton) to perishable higher-value products which would require access to:*

- *Energy (electricity)*
- *Year-round (and responsive) transport options*
- *Labour at key times of the year.*"

(The Centre for International Economics 2017a, p.45)

By taking action on these key aspects, development of agriculture in northern Australia could potentially see diversification and production of more perishable high-value produce, such as:

- *"Livestock value-adding through the core cow-calf operations of the region*
- *Fruit, in particular avocados, mangos, watermelons and rockmelons*
- *Vegetables, including capsicums and chillies, pumpkins, sweet potatoes, yam and cassava*
- *Grains and oilseeds, including sorghum, chickpeas, mungbeans and sunflowers*
- *Animal feedstuffs including feed sorghum, hay and silage*
- *Nurseries and cut flowers including sandalwood."*

(The Centre for International Economics 2017a, pp.45-46)

Figure 2.10 illustrates how development of broad agricultural activities could prove to be synergistic and add value to the economy.

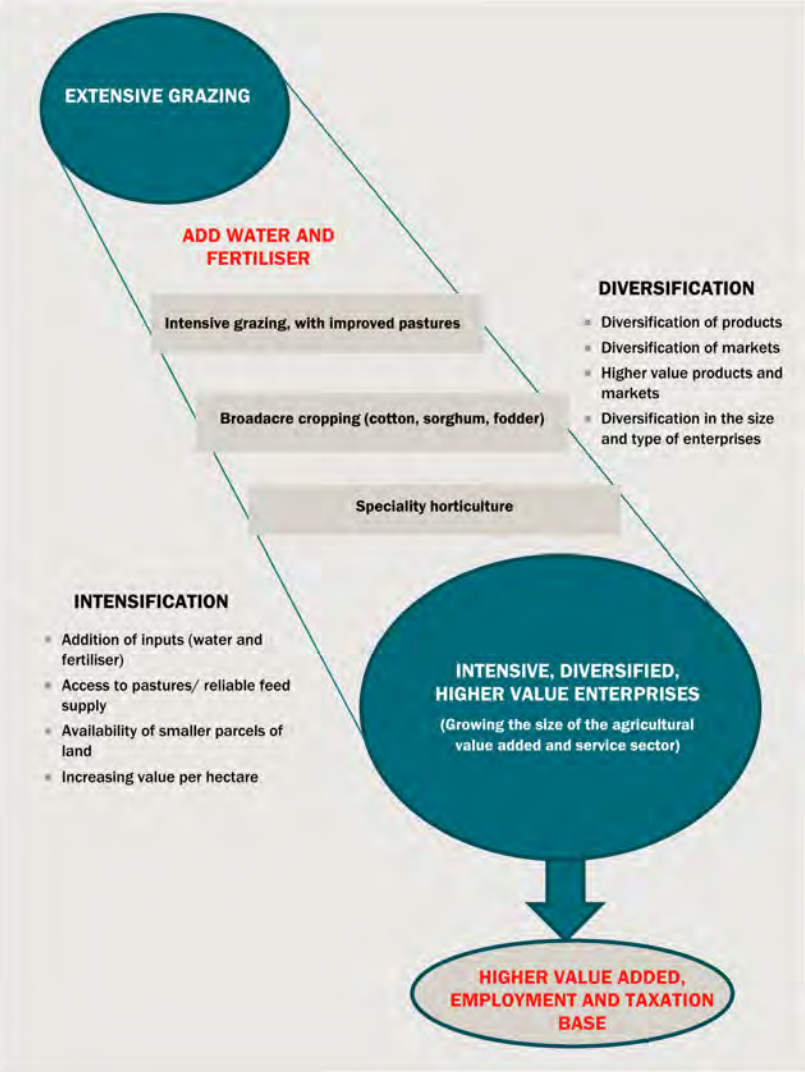


Figure 2.10: A vision for the transformation of agriculture along the corridor (The Centre for International Economics 2017a, p.47)

CSIRO TraNSIT model

CSIRO's TraNSIT model gives a comprehensive understanding of cattle movements in northern Australia. The TraNSIT Model objective is *"to provide a holistic view of the benefits associated with infrastructure investments and policy changes across agriculture supply chains"* (CSIRO 2016, p.1).

One key finding of the CSIRO modelling study is that the corridor between Darwin and Brisbane is the most-utilised corridor for cattle transportation in Australia. Figure 2.11 illustrates this, indicating that net tonnages being transported along the corridor range from 90,000 tonnes per annum near the Darwin end of the corridor and 550,000 tonnes per annum near Brisbane (assuming an average net weight of 20 tonnes per trailer).

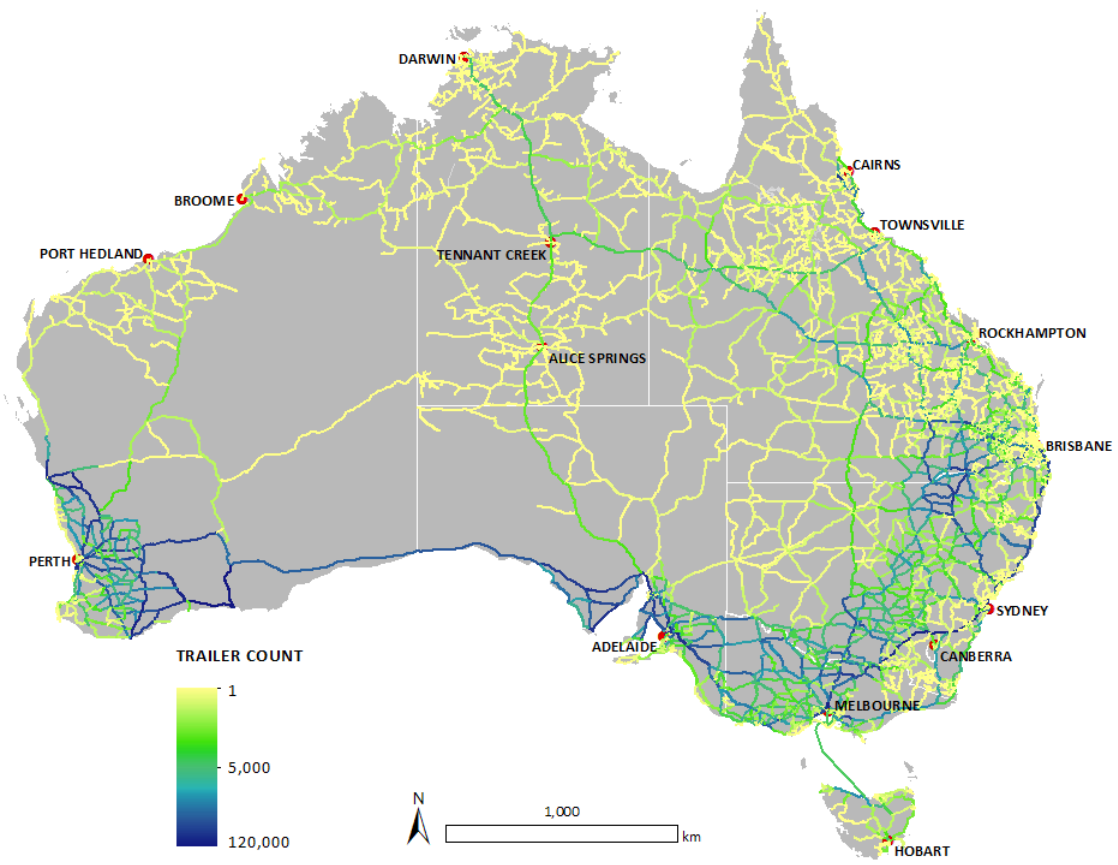


Figure 2.11: Cattle vehicle numbers (semi-trailer equivalents) across the Australian road network as estimated by TraNSIT for an average year between 2008 and 2013 (CSIRO 2016, p.2)

It must be noted that although the Darwin to Brisbane corridor is heavily travelled, individual trips along the corridor may not necessarily be long distances as cattle are often transported from stations to feeding lots, and then to abattoirs.

The anticipated reforms to the charging regime for heavy vehicles are of concern to Queensland as its rail freight network is currently underdeveloped when compared against those of New South Wales and Victoria. Queensland is heavily reliant on road for its freight transport task and the pending heavy vehicle reforms are likely to cause an increase in Queensland's cost of production.

While potential development of the MITCR will link Australia's central and eastern rail networks, in the view of some stakeholders it forms part of a larger nation-wide rail plan that – over the course of 50 years – should seek to increase rail connectivity throughout regional and urban Australia.

> *"The Regional Development Australia Fitzroy and Central West Committee are excited by the economic capacity of the Mount Isa to Tennant Creek rail project to create a connected northern Australia. With the success of this project the future for business owners and investors across the region is bright with the opportunity to diversify supply chain and freight options and match competitors in southern states who have access to road, rail and intermodal options as a matter of course." – Kalair McArthur, Executive Officer, Regional Development Australia*

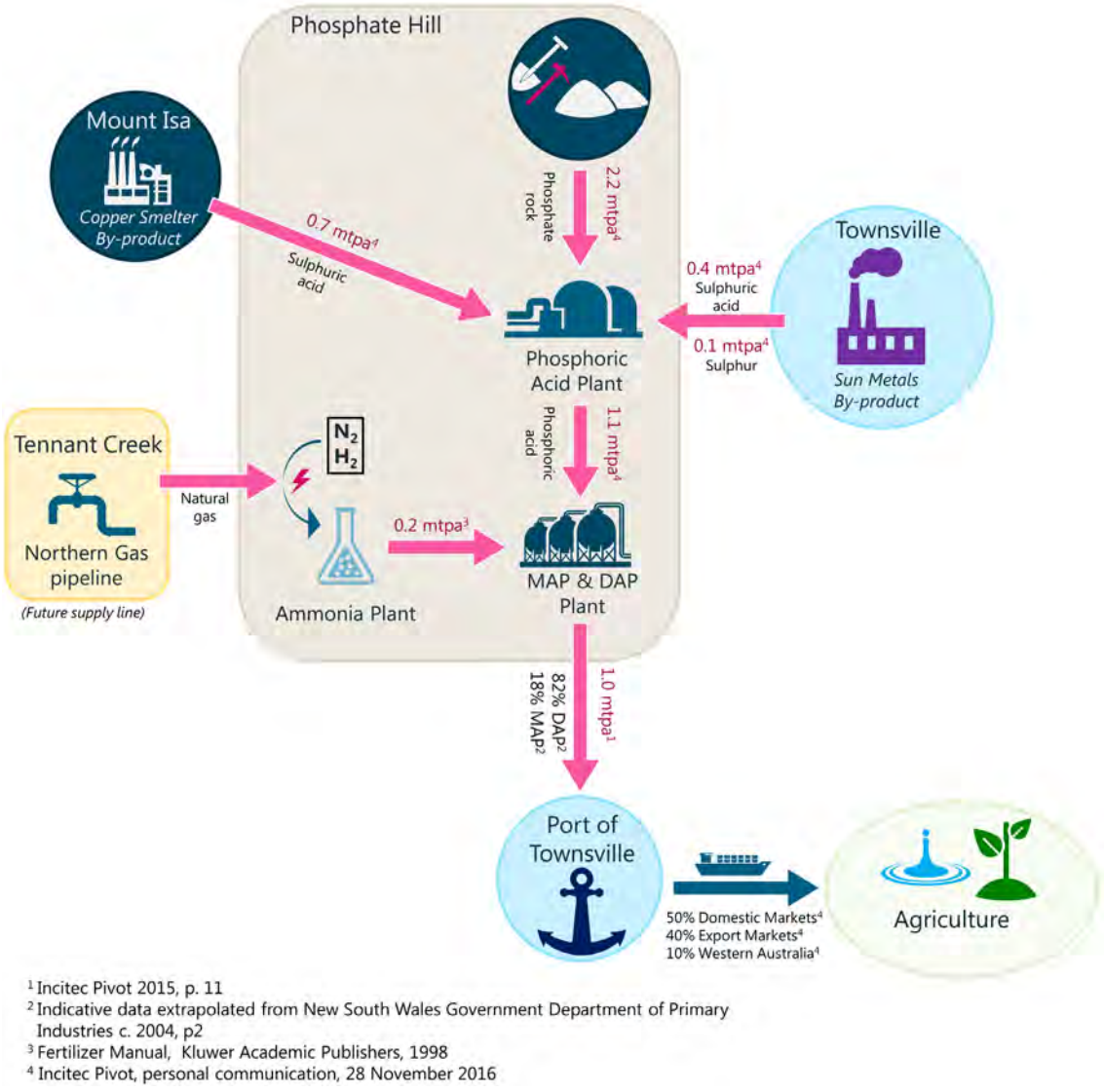
Sector: Freight

By 2032/33, the Bureau of Infrastructure, Transport and Regional Economics (BITRE) estimates that container traffic through Australian ports will increase from 7.2 million to 19.4 million TEUs. Most goods arriving at each port are destined for recipients within 100 kilometres.

Constrained ports such as Port Botany have limited room to expand capacity and additional capacity added often incurs high capital investment when compared against capital costs associated with the expansion of less developed ports in Australia. By allowing rail connectivity between Australian ports and a national rail freight network, additional demand on constrained ports can be absorbed by secondary ports which can then rail their freight to inland intermodal hubs where they are distributed via road.

A northern Australian chemical value chain

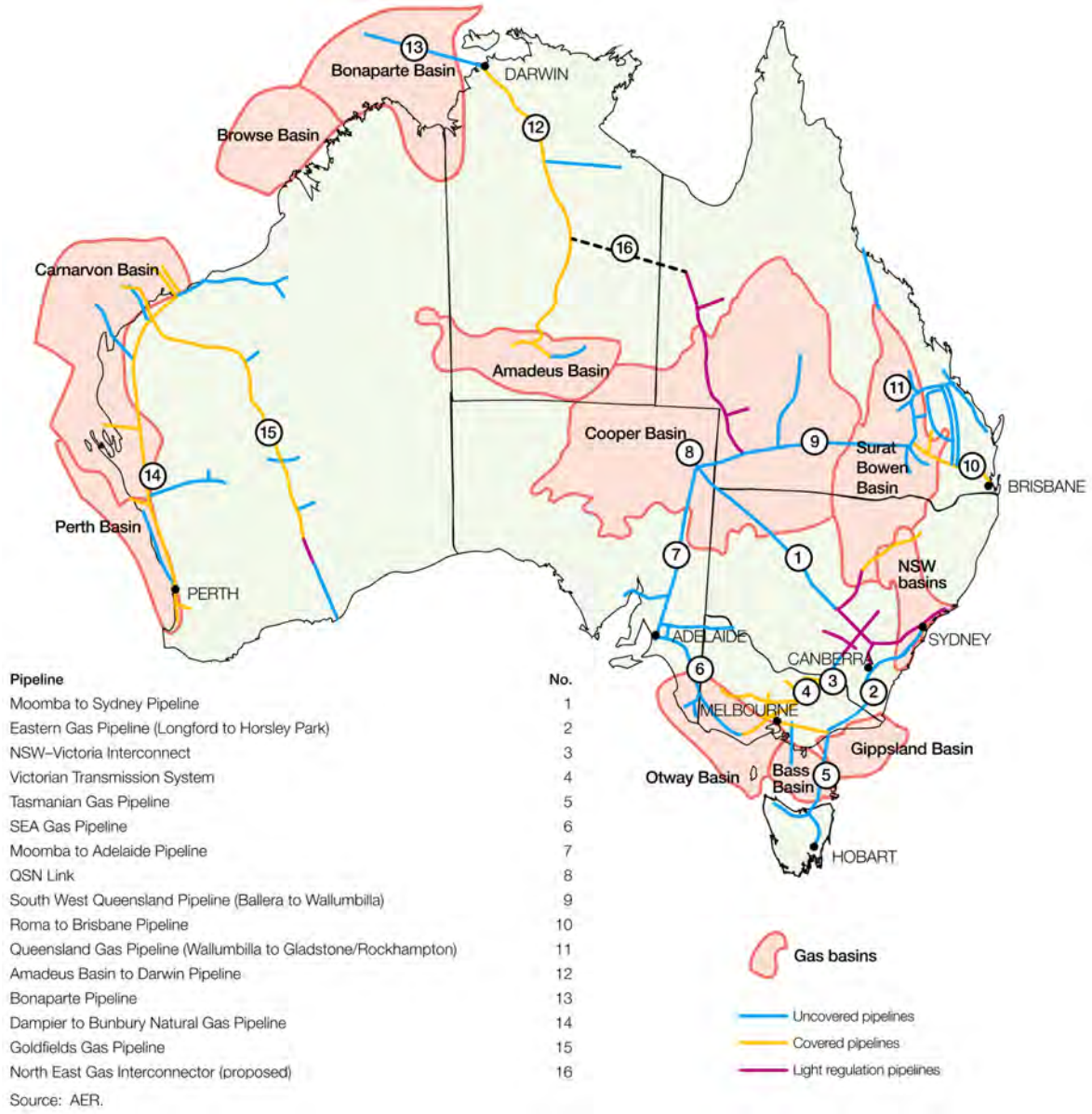
It is important to understand interdependencies that exist within the Mount Isa area. The product of this chemical value chain is mono-ammonium phosphate (MAP) and diammonium phosphate (DAP) type fertilisers which are produced at Incitec Pivot's Phosphate Hill facility and are transported to domestic and international markets via the existing GNR. The main inputs required for the production of MAP and DAP fertilisers are phosphate rock, sulphuric acid and energy (natural gas). Phosphate rock is mined at Phosphate Hill whilst sulphuric acid and natural gas are transported via rail and pipeline to the facility.



[1] Incitec Pivot 2015, p. 11
[2] Indicative data extrapolated from New South Wales Government Department of Primary Industries c. 2004, p2
[3] Fertilizer Manual, Kluwer Academic Publishers, 1998
[4] Incitec Pivot, personal communication, 28 November 2016

Figure 2.12: Illustration of northern Australian chemical value chain interdependencies

Currently natural gas is piped from Queensland via the Carpentaria Pipeline, however construction of the Northern Gas Pipeline between Tennant Creek and Mount Isa will change this, with Incitec Pivot's signing of a 10-year gas supply contract. It must be noted that Incitec Pivot is the foundation customer of the Northern Gas Pipeline and played a pivotal role in enabling the realisation of this pipeline which connects the eastern and central gas networks. The connection of this missing link will increase competition and supply security in the eastern and central gas distribution networks. Figure 2.12 illustrates the Northern Gas Pipeline place in the national transmission network.



Pipeline	No.
Moomba to Sydney Pipeline	1
Eastern Gas Pipeline (Longford to Horsley Park)	2
NSW–Victoria Interconnect	3
Victorian Transmission System	4
Tasmanian Gas Pipeline	5
SEA Gas Pipeline	6
Moomba to Adelaide Pipeline	7
QSN Link	8
South West Queensland Pipeline (Ballera to Wallumbilla)	9
Roma to Brisbane Pipeline	10
Queensland Gas Pipeline (Wallumbilla to Gladstone/Rockhampton)	11
Amadeus Basin to Darwin Pipeline	12
Bonaparte Pipeline	13
Dampier to Bunbury Natural Gas Pipeline	14
Goldfields Gas Pipeline	15
North East Gas Interconnector (proposed)	16

Source: AER.

Figure 2.13: Australian gas basins and transmission pipelines (Australian Energy Regulator 2015, p.91)

The sulphuric acid supply to Phosphate Hill comes from two main sources – the Mount Isa Copper smelter (60 percent) and Sun Metal's zinc refinery in Townsville (40 percent). Recent improvements to environmental performance have allowed the copper smelter to obtain extension for its operations until 2022, at which point the smelter may close (either for reasons of profitability or environmental requirements).

The closure of the copper smelter at Mount Isa could see one of the following scenarios unfold.

- The copper smelter is relocated to Townsville, resulting in an increase of bulk haulage along the GNR and volumes to the Phosphate Hill fertiliser facility remaining constant; or
- The copper smelter closes, impacting negatively on fertiliser production at Phosphate Hill.

Potential closure of the Mount Isa copper smelter is of concern to Incitec Pivot as it threatens the security of acid supply. Should the Mount Isa copper smelter close in 2022, the Incitec Pivot fertiliser facility may be forced to downgrade its output capacity and decrease its gas consumption. For the region this would have a negative social and economic impact. A Mount Isa to Tennant Creek Rail link would potentially alleviate dependency of the Phosphate Hill fertiliser facility on the Mount Isa copper smelter for its supply of sulphuric acid, reducing any potential impact of the Mount Isa copper smelter closure.

Closure of the Mount Isa copper smelter would also have an impact on the GNR which is currently operating as a commercially viable railway. The production of fertiliser at Phosphate Hill currently contributes approximately 2 mtpa of the 5 mtpa of total tonnage being railed over the GNR.

Potential development of other fertiliser facilities in Central Australia

Engagements with private sector entities indicated that there are mixed levels of optimism regarding potential development of another fertiliser facility in Tennant Creek in the next 10 years. Entities optimistic about this prospect believe Australia has a competitive advantage in fertiliser production and also anticipate large quantities being exported to Asia in the future.

The main inputs to the production of MAP and DAP type fertilisers are phosphate rock, energy, ammonium and sulphuric acid. The Northern Territory and western Queensland have access to energy via transmission pipelines and phosphate rock deposits, requiring only small quantities of ammonium and sulphuric acid to be sourced to enable the production of fertiliser.

> *"Proximity to key materials such as phosphate, ammonium, sulphur and natural gas is important as they determine the industry's cost structure and profit margins." – Richardson 2016, p.20*

In addition to MAP and DAP type fertilisers, some private sector entities are also optimistic about the prospect of producing NPK and other fertiliser types, noting that the Northern Territory is one of the few places in the world where most of the required ingredients to make different fertiliser types are located in such close proximity to each other. Rum Jungle is one firm openly indicating intent to pursue the prospect of fertiliser production in Australia in its strategic plan.

> *"[Rum Jungle Resources'} strategic intent is to create shareholder value from phosphate and potash fertiliser mineral projects, located in proximity to existing transport infrastructure, primarily in the Northern Territory…Agriculture is a key plank in 'Developing Northern Australia' initiative." – Rum Jungle Resources 2014, p.4*

Figure 2.14 illustrates how a potential fertiliser production network might look with the MITCR potentially linking the central and eastern rail networks, enabling increased fluidity of minerals, chemicals and fertiliser between mines, smelters, fertiliser facilities, agricultural areas and ports. This scenario could have potential to induce long-term economic activity in northern Australia.

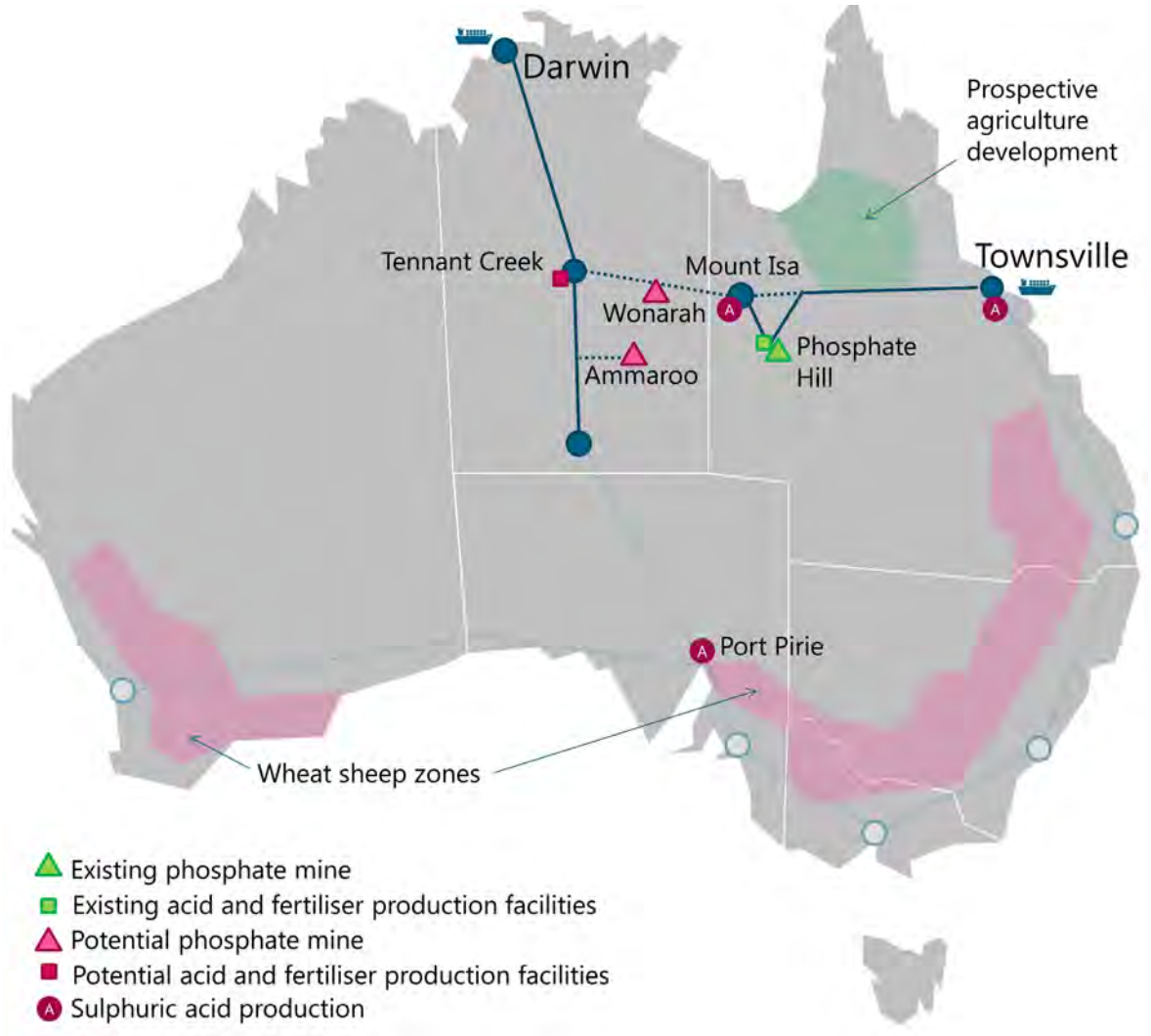


Figure 2.14: Potential fertiliser developments in central Australia

Notwithstanding the optimism held by some private sector firms, there are also those that are not optimistic about future fertiliser facility developments in Australia. Entities sharing this doubt believe that Australia does not have a competitive advantage that enables it to compete in the international fertiliser market. Reasons for this include relatively higher labour costs and increased transport costs due to long distances. The current fertiliser facility at Phosphate Hill is noted to be one of the most remote fertiliser facilities in the world. The potential progression of the MITCR can only carry positive benefits for the prospect of developing Australia's fertiliser potential.

2.2.4 Results and projections for various economic scenarios

Projections of production and volume throughput

Resulting from the construction of MITCR Option 2B, Figure 2.15 demonstrates the gross value of production that is anticipated for the MITCR corridor under different price scenarios.

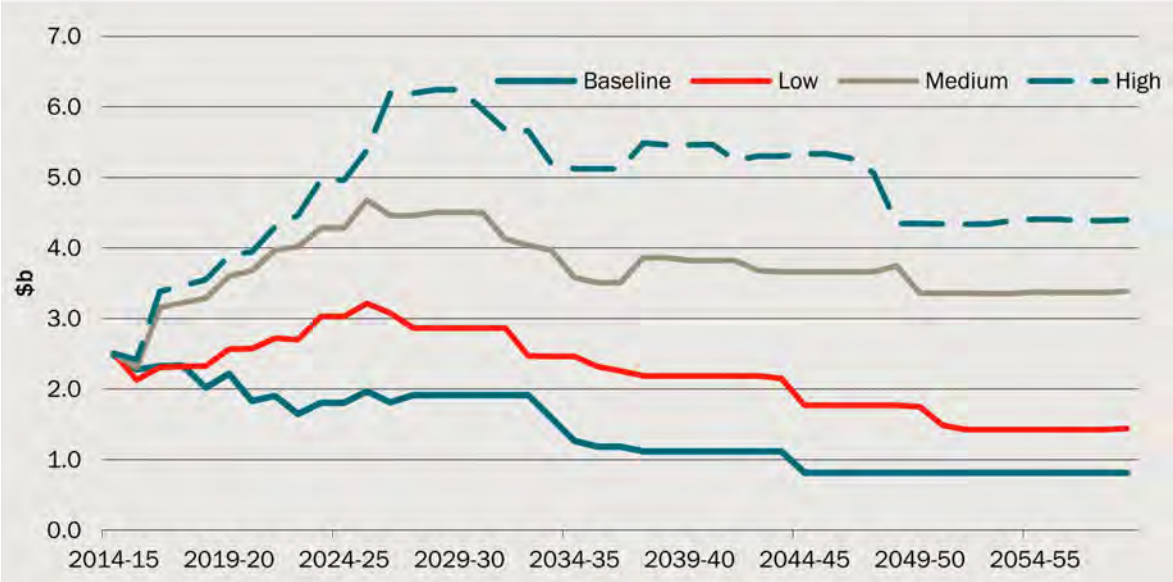


Figure 2.15: Projections of gross value of production from the MITCR corridor (The Centre for International Economics 2017a, p.100)

Forecasts of rail demand along the Darwin to Townsville corridor are illustrated in Figure 2.16 with detailed volume movements shown in Figure 2.17.

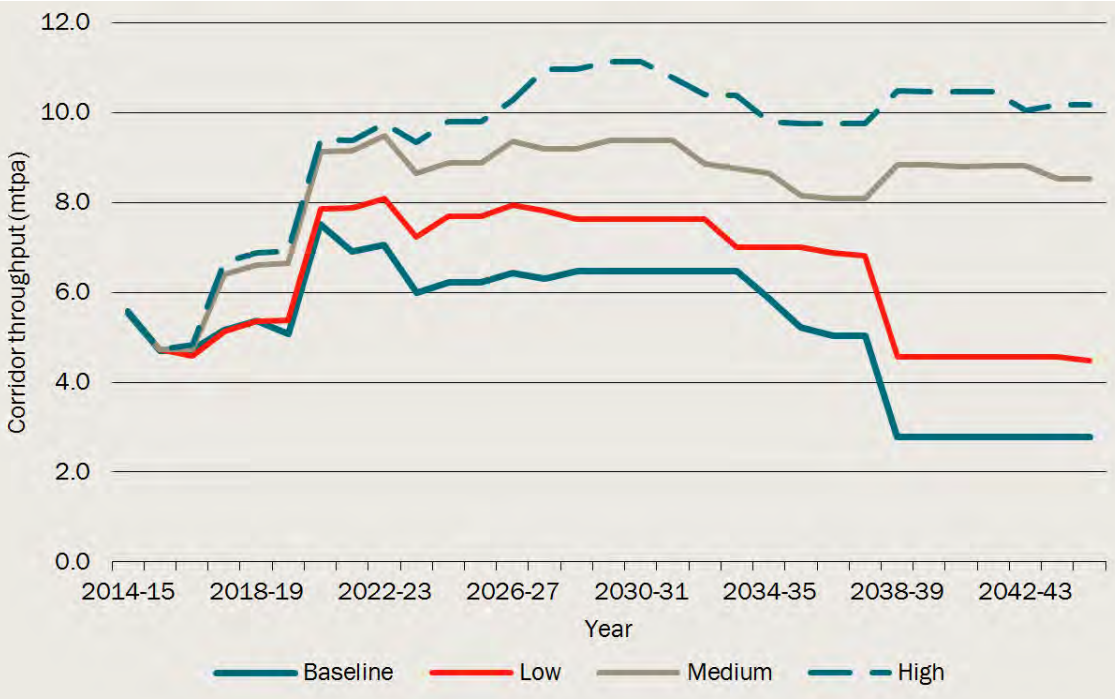


Figure 2.16: Projections of rail demand along the Darwin to Townsville corridor (Source: The Centre for International Economics)

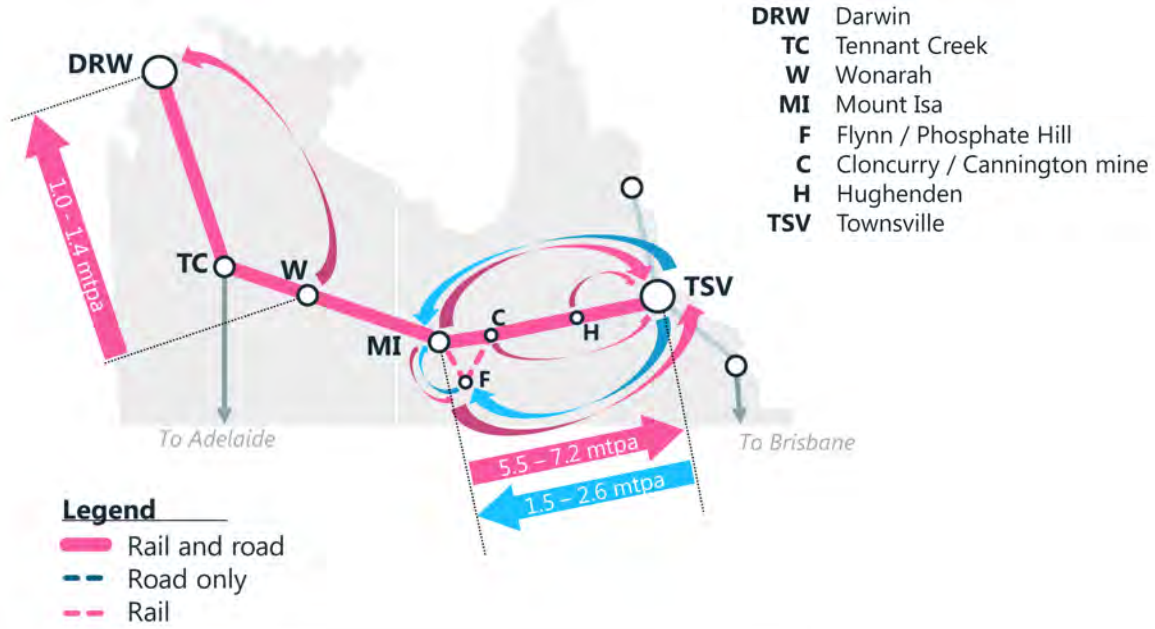


Figure 2.17 Forecasted movement of freight volumes along the Darwin to Townsville corridor in year 2035 for Low (lower bound range) and High (upper bound range) demand scenarios (assuming policy reform and construction of MITCR)

(Source: The Centre for International Economics)

Projections of additional revenue from the MITCR

Access to resources and derived revenues

The governments' value capture via the sale price is expected to be some portion of the total value of the available resource. Table 2.19 provides an estimate of the possible value of additional resources expected to be exported from the corridor.

Scenario	Total Increase ($b)	NPV of Total Increase ($b)
Low	44.7	15.9
Medium	156.5	46.6
High	195.1	61.0

Table 2.19: Estimated additional resources exported (billions) in period 2022-2060 (The Centre for International Economics 2017a, p.100)

Note: These estimates were developed using an estimate of resource value per tonne ($100) multiplied by the CIE's estimates of increased total tonnes of product exported. NPV was estimated in 2016 dollars and discounted by 5% WACC.

Source: The CIE..

The low estimate of value capture for selling resource packages at 20 percent of the expected value of the additional resources should recover most of the cost of the MITCR. Other value capture and intangible benefits would add to the total net benefit to the economy and the government's fiscal position (refer Table 2.20).

Scenario	Total Increase ($b)	NPV of Total Increase ($b)
Low	8.9	3.2
Medium	31.3	9.3
High	39.0	12.2

Table 2.20: Estimated government value capture from selling resource packages for 20 percent of expected value (millions) in period 2022-2060 (The Centre for International Economics 2017a, p.100)

Note: These estimates were developed using an estimate of resource value per tonne ($100) multiplied by the CIE's estimates of increased total tonnes of product exported. NPV was estimated in 2016 dollars and discounted by 5% WACC.

Source: The CIE.

Royalties

Using an average royalty rate of $8.15 per tonne for the additional volumes extracted, it can be estimated that royalties from potential new mines and attributable to the MITCR would be as per Table 2.21.

Scenario	Total Increase ($m)	NPV of Total Increase ($m)
Low	$447	$159
Medium	$1,565	$466
High	$1,950	$610

Table 2.21: Estimated increase in royalties for Queensland (millions) in period 2022-2060 (The Centre for International Economics 2017a, p.101)

Note: These estimates were developed using a royalty rate of $8.15 per tonne multiplied by the CIE's estimates of increased total tonnes of product exported. NPV is estimated in 2016 dollars and discounted by 5% WACC.

Source: The CIE.

Projections of Gross Regional Product (GRP) and Gross State Product (GSP)

A range of estimates for GRP and employment for the MITCR corridor have been generated using economy-wide modelling. These are illustrated from Figure 2.18 to Figure 2.21. The High, Medium and Low price scenarios assume that policy action is taken in a short timeframe. The Baseline and Investment phase scenarios assume no policy reform takes place.

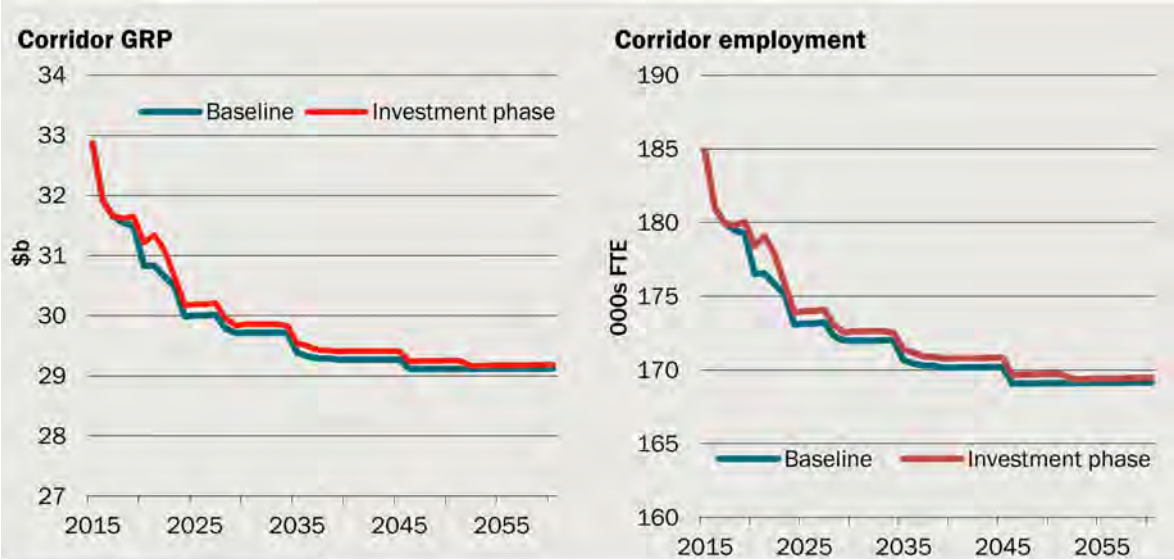


Figure 2.18: Likely benefits of stand-alone MITCR (Option 2B) investment without policy reform (The Centre for International Economics 2017a, p93)

GRP = gross regional product.

Note: GRP in 2015 dollars.

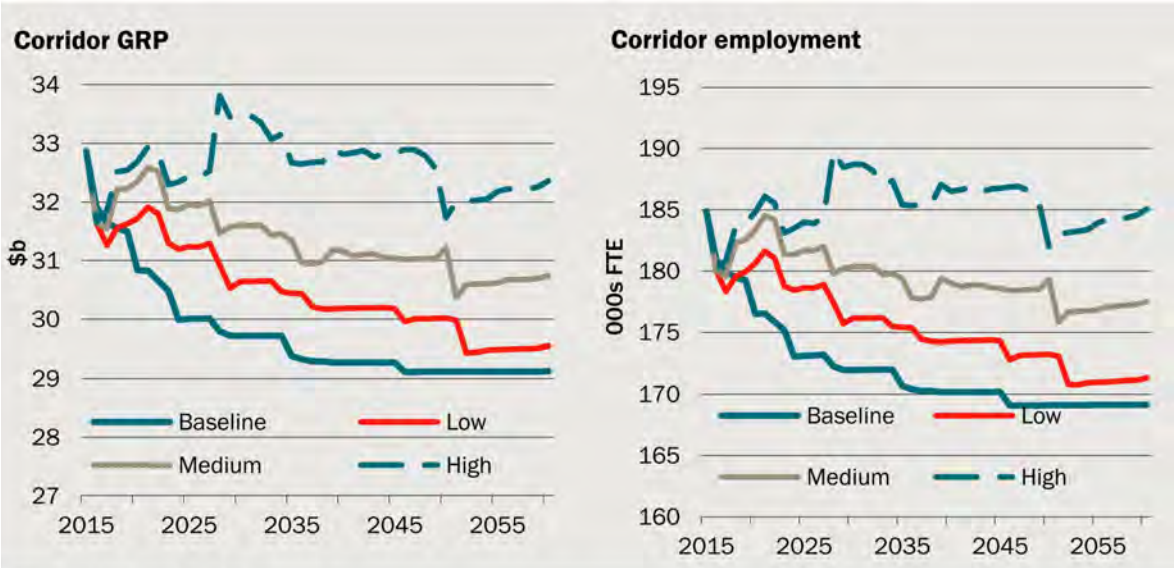


Figure 2.19: Projections of corridor GRP and employment – 2015 dollars (The Centre for International Economics 2017a, p93)

GRP = gross regional product.

Note: GRP in 2015 dollars.

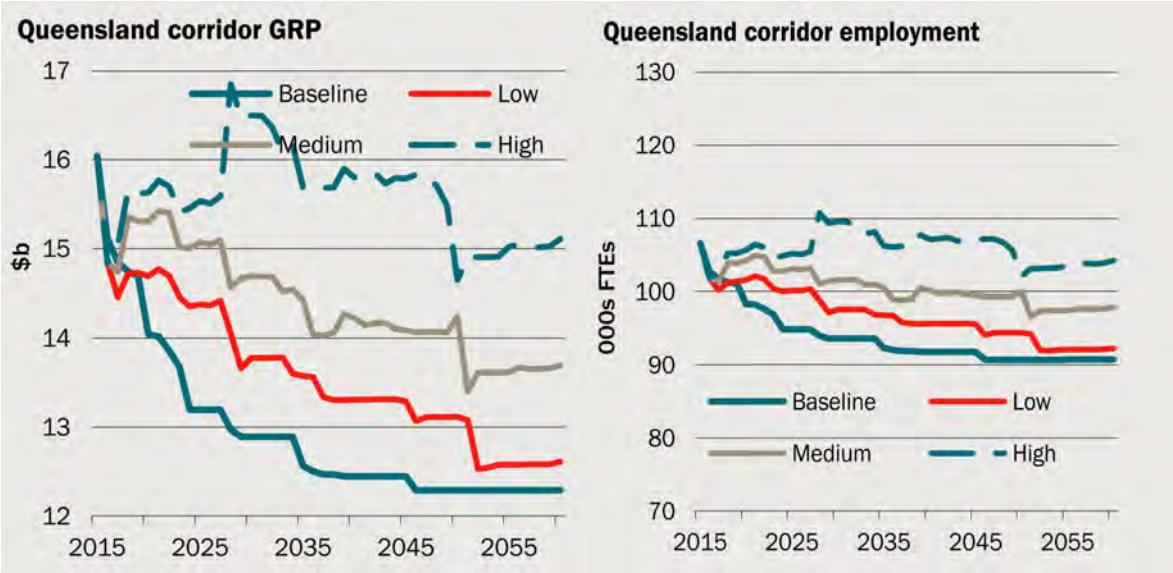


Figure 2.20: Projections of Queensland corridor GRP and employment – 2015 dollars (The Centre for International Economics 2017a, p94)

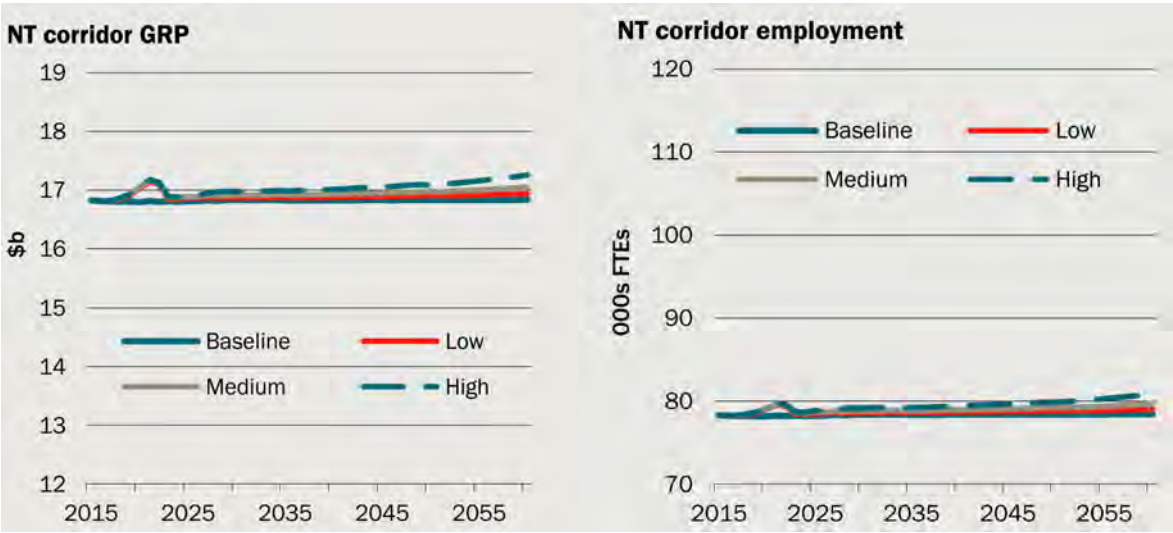


Figure 2.21: Projections of Northern Territory corridor GRP and employment – 2015 dollars (The Centre for International Economics 2017a, p94)

Table 2.22 illustrates the aggregated potential benefits associated with investment in the MITCR project in 2015 dollars. Uncertainties such as unidentified mineral deposits, unknown dormant industries, and coal and container related volumes are not included in the tabled benefits.

Improvement in gross regional product	Description	Capital expenditure ($b)	Total corridor GRP ($b)	Queensland corridor GSP ($b)	NT corridor GSP ($b)
MITCR investment phase only	Construct MITCR Option 2B No policy reforms	3.4	3.9	3.1	0.7
MITCR strategy — low-price scenario	Construct MITCR Option 2B No policy reforms	3.4	11.7	11.0	0.7
MITCR strategy — medium-price scenario	Construct MITCR Option 2B No policy reforms	3.4	24.7	23.3	1.3
MITCR strategy — high-price scenario	Construct MITCR Option 2B No policy reforms	3.4	42.7	40.5	2.2

Table 2.22: Comparison of capital expenditure and potential benefits under different price scenarios from MITCR investment – 2015 dollars (The Centre for International Economics 2017a, p95-96)

Note: In present value terms, using a real discount rate of 5% over the period from 2015 to 2050. For the investment phase, 10% of the long term benefits of the low-price scenario are assumed to be realised beyond construction of the rail line.

Source: The CIE.

2.2.5 Infrastructure considerations

Locations where there is a confluence of energy, water and transport infrastructure create hubs which can stimulate development. These potential hubs are shown in.

Economic development opportunities

The Tennant Creek to Mount Isa corridor's natural resources, in the form of mineral deposits and underground water, provide opportunity for mining and agricultural development of the region. Much of the region's mineral deposits remain unexploited due to the remote location, patchy mineral resources data and limited infrastructure.

Economic development – be it agriculture or resources – requires three key enablers:

- Water
- Energy
- Transport.

The region has known and prospective mineral resources, groundwater availability and construction is due to start on a Tennant Creek to Mount Isa Gas Pipeline in 2017 which will enable prospective developments to have access to energy

Agricultural potential

Agricultural development requires water and suitable soils. Outlined below are the current status of the key elements required for potential regional development founded on mining and agriculture. Suitable supply chain transport infrastructure is the other important component to support the development and operations of mining and agricultural growth. The transport solution options are discussed in Section 4.

"To secure the ongoing prosperity and wellbeing of our community, it is critical that adequate planning for water, power and infrastructure to be centralised to ensure that our infrastructure meets the needs of current and future generations."

"To grow and prosper into a connected, sustainable and prosperous city, Mount Isa needs the necessary and fair provision of enabling infrastructure."- Cr. Joyce McCulloch, Mayor, Mount Isa City Council

Resources

The area between Tennant Creek and Mount Isa is considered to have large untapped potential for minerals and petroleum, but remains substantially underexplored due to a lack of outcropping geology and a thin cover of limestone and black soil that covers the prospective geology. The Northern Territory Geological Survey and Geoscience Australia are prioritising the area between Tennant Creek and Mount Isa for an intensive program of geoscience from 2016 to 2020 as part of the Commonwealth Government's 'Exploring for the Future' program. This will include geophysical surveys, interpretive mapping, drilling and seismic, to demonstrate to industry where prospective geology occurs at explorable depths under the black soil plains of the Barkly. This is likely to stimulate exploration through the region, and increase the prospect of resource development.

The area around Mount Isa is the location of some of the world's largest mineral deposits (copper, lead, zinc, silver and phosphate rock) and has a very high concentration of existing and potential mines and mineral projects, refer to Appendix B.

Energy

Electrified power lines in northern Australia are highly fragmented with sources of energy serving small individual population clusters spread across sparse geographic areas. The exceptions to this are the inland and coastal areas of north-eastern Queensland which benefit from the state-wide transmission network (refer Figure 2.22). The main source of energy throughout the northern parts of the Northern Territory and Queensland is gas, piped through major distribution pipelines.

Figure 2.22: National electricity transmission lines (Australian Government Geoscience Australia 2014)

Water and Soils

Northern Territory

The key aquifer in the Georgina Basin is the Gum Ridge Formation between Tennant Creek, Barkly Homestead and north to Daly Waters. This limestone aquifer extends across the basin, covering 95,100 square kilometres. It hosts groundwater resources that are prospective for large agricultural or mining development (Northern Territory Government Department of Environment and Natural Resources 2016). Figure 2.23 illustrates the register bores within the Tennant Creek Mount Isa corridor. Groundwater prospects decrease towards the east of the Barkly Homestead, but yields in this area are generally 0-3l/s with possible higher yield when geological features intersect. The Northern Territory Water Resources Division, DPI, has not conducted studies of the Camooweal Dolostone, near the border. However, bores in this aquifer indicate that high yield may be achievable. The estimated Gum Ridge Formation aquifer maximum total extraction rate is 1,400GL/year, subject to the need to protect groundwater dependant ecosystems.

Soil adjacent to the Barkly Highway, west of the Tablelands Highway, has been assessed to have moderate capability for agricultural development, consisting of deep, well drained, sandy or loamy texture soils (Northern Territory Government Department of Land Resource Management 2016). Some potential crop types include sub-tropical and semi-arid tropical fruit, vegetables, herbs, hay and fodder. There is currently no existing agricultural cultivation in this area. Refer to Appendix B – Soils Classification Map.

The Barkly Highway follows a watershed boundary, with ‘clays’ north of the highway and ‘sandplains’ south of highway. North of the highway, 'Gilgai clays' are prone to shrink swell and ‘minor shrink swell clays’ can be cropped and are potentially suitable for fodder corps or pasture. Severe shrink swell causes problems with cropping. There has been some anecdotal interest from pastoral companies in the area for producing irrigated fodder. Generally, soil and water data is better known on the northern side of the highway.

Queensland

The Flinders River catchment includes Mount Isa, Cloncurry, Julia Creek, Richmond and Hughenden and flows to the Gulf of Carpentaria. The Flinders catchment has the potential to support irrigated agricultural development (10,000 to 20,000 ha) approaching the scale of the current Ord River Irrigation Area, in 70 to 80 percent of years. Irrigation on this scale would be based upon water stored in on-farm dams, pumped from the river or captured as overland flow in flood events. The area of irrigated agriculture would vary significantly from year to year and may not be possible in dry years. The area of soil moderately suitable for irrigated agriculture is more than 8 million ha (CSIRO n.d.). Refer to Appendix B.

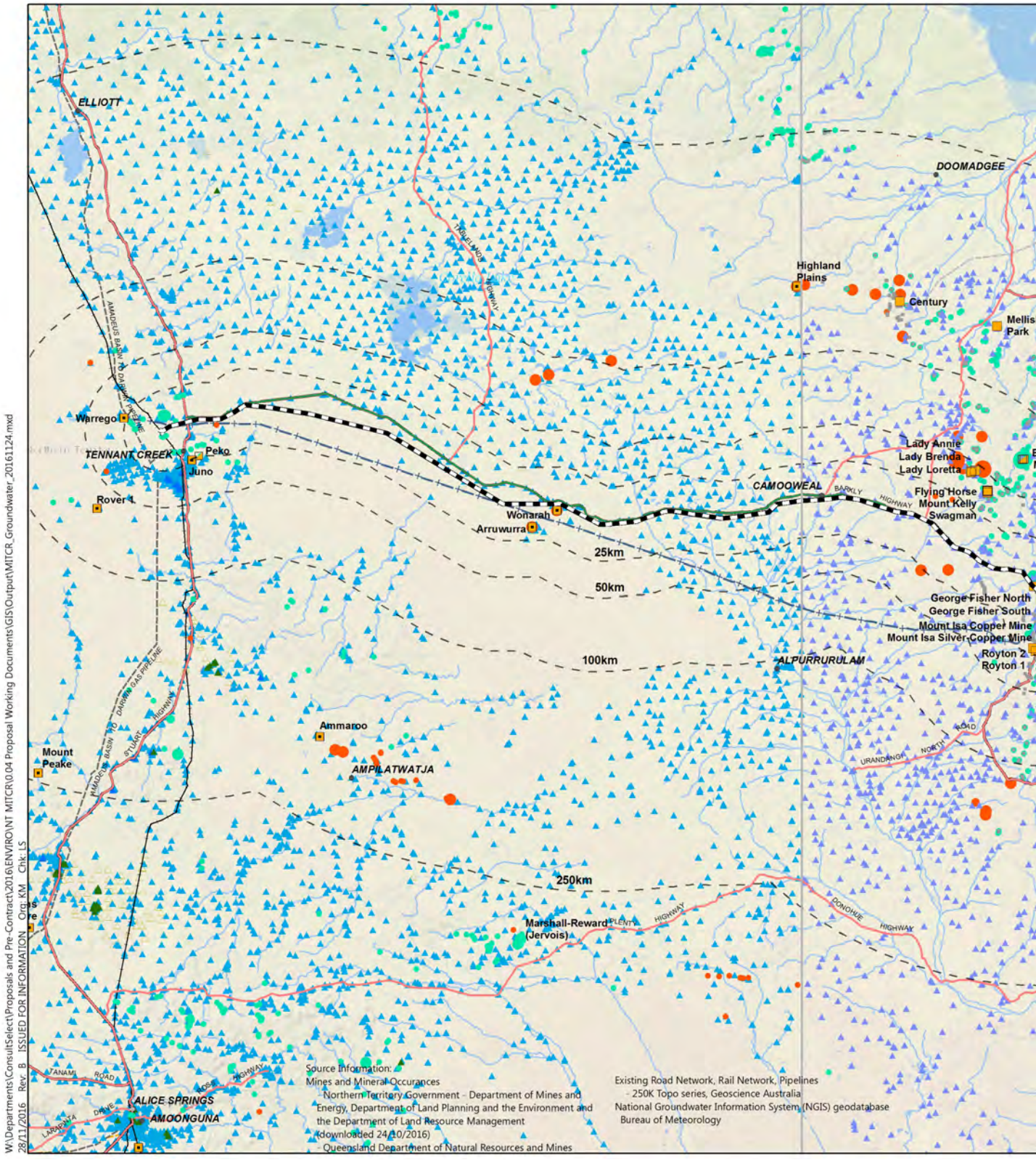
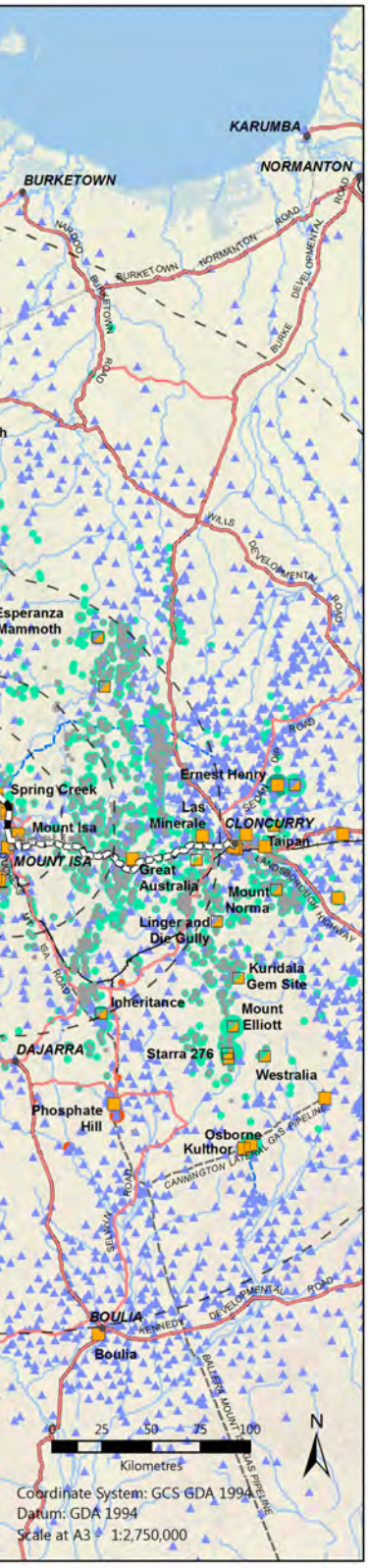


Figure 2.23: Map of potential confluence



Mount Isa to Tennant Creek Rail Link

Groundwater bore locations, resources (copper and phosphate) location and potential rail alignment

Mount Isa to Tennant Creek Rail Alignment (potential)

Mount Isa To Cloncurry direct (potential)

Mines

- Abandoned
- Care and maintenance
- Feasibility
- Operating

Groundwater use

- Irrigated agriculture
- Domestic use
- Water supply
- Unknown
- Monitoring

Major commodity

- Copper, Occurrence
- Copper, Small
- Copper, Medium
- Copper, Large
- Copper, Giant
- Phosphate, Occurrence
- Phosphate, Small
- Phosphate, Medium
- Phosphate, Large

Existing infrastructure

- Principal Road
- Secondary Road
- Railway
- Railway (abandoned)

While every care is taken to ensure the accuracy of this data, WorleyParsons makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which might be incurred as a result of the data being inaccurate or incomplete in any way and for any reason.

Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors
Source: US National Park Service

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WorleyParsons Group

2.3 National competitiveness

2.3.1 Competitiveness in Australia

Regulation of infrastructure assets is often required due to their monopolistic nature. Despite imposed regulations on competitive behaviour by agencies such as the Queensland Competition Authority, there are often issues around access and pricing.

One advantage of the MITCR is its potential to offer real competition to miners and other users in the Mount Isa area. Option 2B proposes a dual-gauge link between Mount Isa and Cloncurry which gives exporters the option to export via either Darwin or Townsville. This would induce competition not only along the railway and between ports, but it would force the two supply chains to compete with each other, encouraging higher levels of efficiency between port and rail operations at both ends. The resulting benefit to railway users and the regional economy would be the reduction in cost of production that would effectively make Australian goods more competitive internationally.

The 2015-16 Global Competitive Report ranks Australia as the 21st most competitive country among 140 countries in the world. In 2012-13 Australia was ranked the 20th most competitive out of 144 countries (Sala-I-Martin et al. 2014, p.114). From the 2015-16 report several key points highlighted areas where Australia could make improvements to enhance its international competitiveness (Schwab & Sala-i-Martin 2016, pp.100-101). These are outlined below.

- *Inadequate supply of infrastructure* was identified as the sixth most problematic factor for doing business in Australia (out of 16 identified factors)
- Australia ranked 80/138 for *burden of government regulation*
- Australia ranked 35/144 for *quality of overall infrastructure*
- Australia ranked 41/144 for *quality of roads*
- Australia ranked 34/144 for *quality of railroad infrastructure*
- Australia ranked 32/144 for *quality of port infrastructure*
- Australia ranked 61/144 for *value chain breadth.*

The frameworks used by the World Economic Forum to assess the competitiveness of a nation consists of three stages into which there are 12 key quantifiable measurements (or pillars). As economies develop they progress from the first stage (*Basic Requirements*) to the last (*Innovation and Sophistication*). Below illustrates these frameworks.

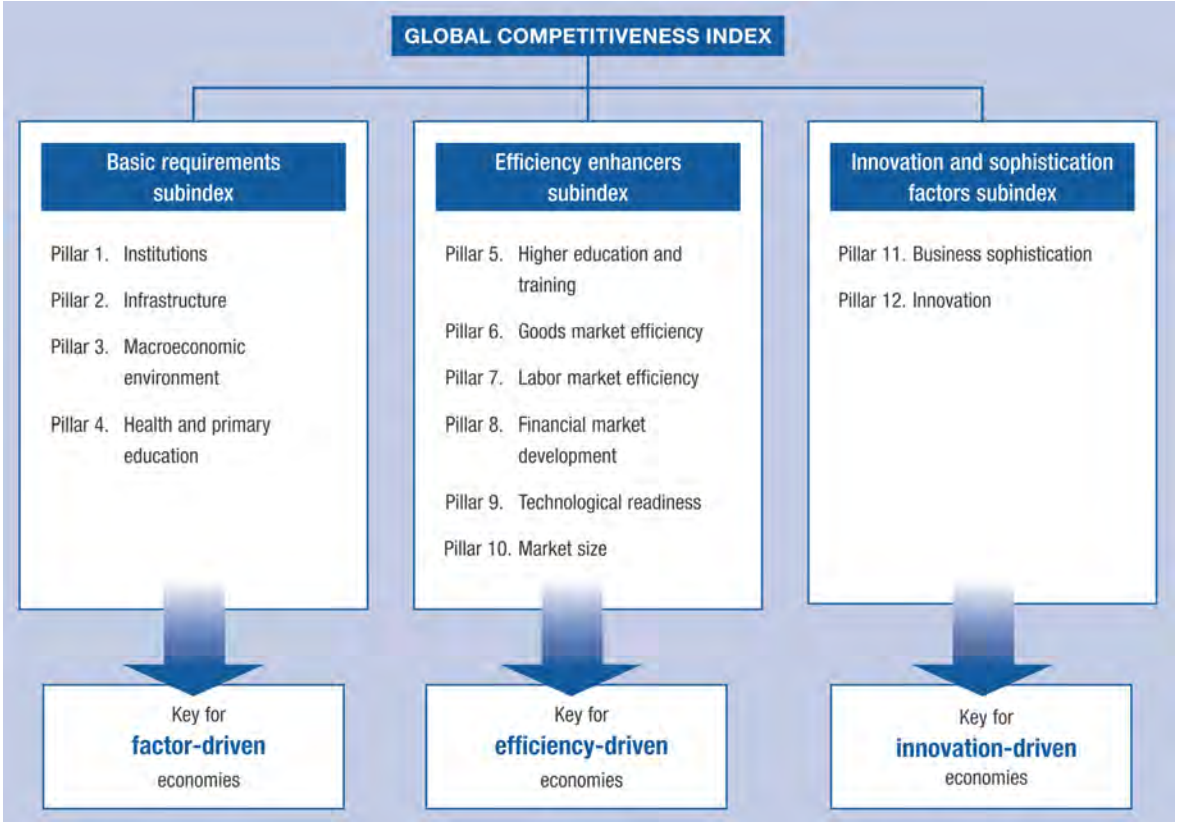

Figure 2.24: Stages of economic development and the 12 Pillars of Competitiveness (Sala-I-Martin et al. 2014, p.9)

Of particular relevance to the role infrastructure plays in competitiveness, the report notes the following:

"Well-developed infrastructure reduces the effect of distance between regions, integrating the national market and connecting it at low cost to markets in other countries and regions (Schwab, & Sala-i-Martin 2014, p.6).

2.3.2 International context

World Economic Forum data on global rail investment is shown in Figure 2.25 (BMI Research 2015). The development of rail infrastructure in Asia has a pipeline of almost $800 billion of investment in place while North America and Western Europe has just over $300 billion.

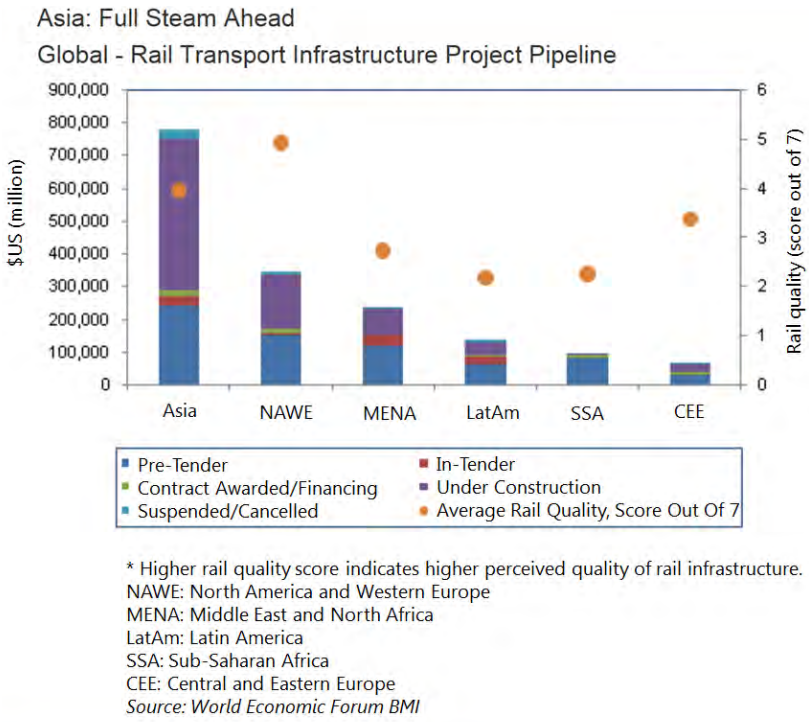

Figure 2.25: Global rail investment (BMI Research 2015)

2.3.3 Asia

The Asian Development Bank predicts that on regional connectivity projects alone, South East Asia expects investments of $33.7 billion in rail and $11.1 billion in ports.

PwC and Oxford Economics have forecast infrastructure investment in South East Asia and highlight the following:

- The Asian market, driven by China's growth, is forecasted to represent nearly 60 percent of global infrastructure spending by 2025
- Growing urbanisation in emerging markets such as the Philippines and Indonesia should boost spending for vital infrastructure sectors such as water, power, and transportation
- Increasing prosperity in emerging markets is expected to drive infrastructure financing toward consumer sectors, including transportation, and manufacturing that provide and distribute raw materials for consumer goods.

Forecasts for transport infrastructure investment in selected major South East Asian nations are as extracted in Figure 2.26. The report predicts that a rail boom is underway in Thailand, explained by the commencement of the US$12.3 billion Thai-Laos-China inland rail project, while PwC also highlight that close to $100 billion in rail and port investment is planned in Indonesia across 2015–2019.

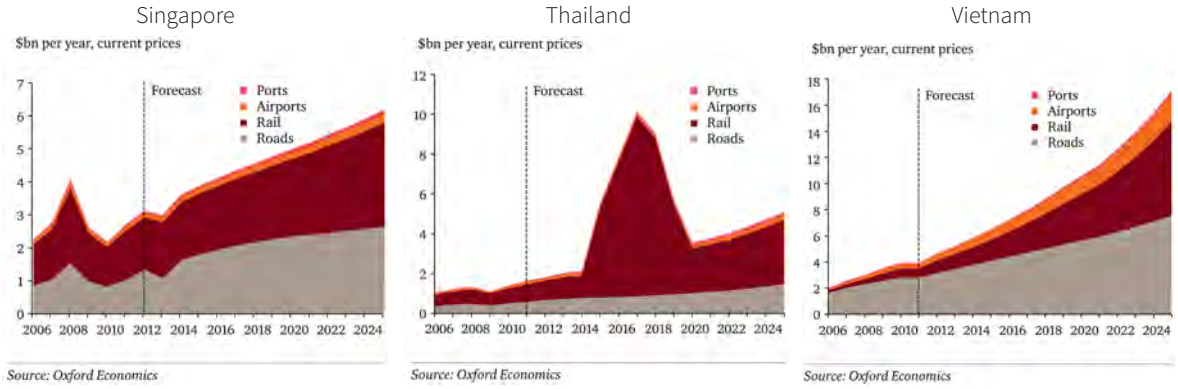

Figure 2.26: Transport infrastructure investment by country (PriceWaterhoueCoopers 2014b)

The economic outlook for the Asia region is expected to stabilise with economic growth slowing to an average of 5.3% across the region for FY 2017 (International Monetary Fund 2016, p.1). Countries experiencing increased standards of living have become more consumeristic and started moving operations offshore to locations in Africa. As countries such as China start experiencing decreased levels of international demand due to the off-shoring of activities, domestic demand must increase to cushion this transition. The Asian Development Bank notes that in order to sustain economic growth such that Asian countries can continually reduce poverty levels it must spend $8 trillion on infrastructure between years 2013 and 2020 (Asian Development Bank 2013).

As identified by the Asian Development Bank, Asian economies currently have $33.7 billion of railway projects in the pipeline, of which $5.1 billion are identified as priority projects (Asian Development Bank 2015, p.2 & 4). To enable railway connectivity between Asian countries, the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) has developed a Trans-Asian Railway plan that enables inter-country railway transit by identifying major corridors and points where railway gauge change must occur (United Nations 1999). Refer to Appendix C for the UNESCAP trans-Asian railway map.

Vietnam

As part of the Trans-Asian Railway, Vietnam is currently studying the potential impacts a north-south high-speed railway would bring to its economy. The ambitious project was rejected in 2010 with an estimated price tag of $56 billion – nearly half of Vietnam's GDP (Rogers 2016) – but has come into consideration again due to the current poor state of the country's railway network. Vietnam, currently ranked 48th for quality of railroad infrastructure (World Economic Forum, 2015-16 Global Competitiveness Index), has one main railway corridor stretching from north to south which is utilised primarily for passenger transport. Given that Vietnam's farthest inland point is 600km from the coastline and all major industrial zones reside within 200km of the coastline, rail has no cost advantage over road for freight transportation. Rail accounts for only 1 to 3 percent of Vietnam's freight traffic with the remainder being transported via sea/river and road.

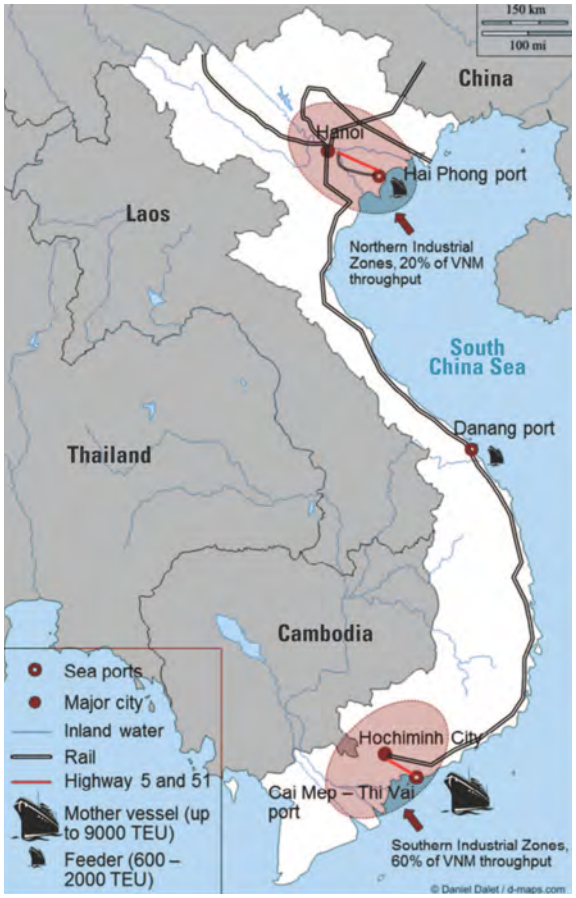

Figure 2.27: Vietnam Freight infrastructure (Ward & Pham 2011, p.3)

China

In 2015 China invested over USD$125 billion in railway projects and for each of 2016 and 2017. It is planning to maintain railway expenditure at around USD$115 billion China's total railway network length is approximately 121,000 kilometres, second only to that of the United States at 250,000 kilometres. The country has the greatest quantity of high speed track infrastructure (approximately 19,000 kilometres), about 60 percent of the world's total. (New China 2016 & Reuters 2017)

China's interest in developing high speed rail infrastructure stretches beyond its boundaries as it seeks to make the engineering and construction of infrastructure another of its exports. It has perused high speed rail opportunities abroad in countries like Mexico, the United States, Thailand and Indonesia (Minter 2016). Despite a number of these prospective developments faltering due to high capital cost requirements, Malaysia is one country looking to progress with a USD$13 billion rail development which will be built and financed with a seven-year interest free period by China. The memorandum of understanding signalling the commencement of this project is just one of 16 inter-governmental agreements that are to be signed between China and Malaysia. The Malaysian high speed rail development is to link Klang Valley to Tumpat in Malaysia with hopes that it will stimulate economic development along the country's East Coast Rail Link. (The Jakarta Post 2016 & Tetsuya 2016)

Figure 2.28: China high speed railway network map (JohoMaps n.d.)

Of particularly importance to global economic integration is China's OBOR initiative. This is shown in Figure 2.29 below. The OBOR is made up of a 21st Century Silk Road Economic Belt and a 21st Century Maritime Silk Road, supported by Chinese-funded infrastructure projects. China acknowledges northern Australia's potential to become part of the OBOR. This will not ony give Australia access to Chinese capital, but also provide opportunity for Australian firms to build relationships with China and work on OBOR related projects in Australia and beyond.

King & Wood Mallesons (2016) note three main areas where Australia service sectors can benefit directly from the OBOR initiative.

- **Financial services:** Australian project financiers are noted to be particularly skilled at structuring innovative financing options. Sydney is the G20 Infrastructure Hub and has become an offshore Renminbi (RMB) hub for facilitating cash and security transactions in the APAC region. This positions the city to be the central location for infrastructure decision-making and financing. Sydney is noted to have the necessary financial infrastructure to become a "*major gateway for capital flows in and out of China.*" (King & Wood Mellesons 2016)
- **Professional services:** Australia has world-class expert advisors capable of delivering infrastructure projects. Australian firms will have the potential to offer services to OBOR-related infrastructure projects.
- **Information technology services:** Australian firms are highly ranked in telecommunication infrastructure. With connectivity being one of the OBOR policy objectives, Australian firms specialising in this area will have the opportunity to expand their activities. Australia's increasing skills in the areas of big data, Internet of Things (IoT) and e-commerce also have potential for further expansion via Australia's involvement in OBOR.

Darwin's geographical position gives it the potential to be Australia's connection to OBOR. As a transport hub connecting to Asia, Darwin could also open up northern Australia for further economic development and capital inflows provided the right business environment exists.

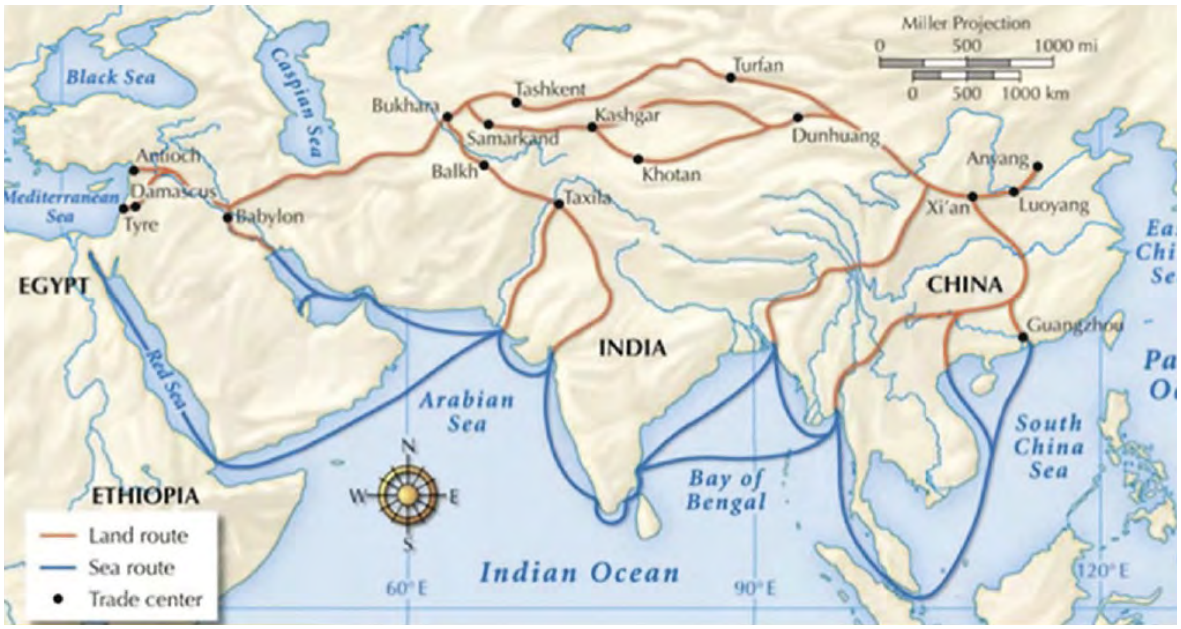

Figure 2.29: China's One Belt One Road initiative (Pakistan Defence 2016)

From Australia's perspective: Darwin is the gateway into the Chinese 21st Century Silk Road.

2.3.4 North America

"A high quality transportation network is vital to a top performing economy. Investments by previous generations of Americans – from the Erie Canal in 1807, to the Transcontinental Railroad in 1869, to the Interstate Highway System in the 1950s and 1960s – were instrumental in putting the country on a path for sustained economic growth, productivity increases, an unrivalled national market for goods and services, and international competitiveness. But today, current estimates indicate that America's transportation infrastructure is not keeping pace with demands or the needs of our growing economy, for today or for future generations." (The Whitehouse 2014, p.2)

"The economic benefits of smart infrastructure investment are long-term competitiveness, productivity, innovation, lower prices, and higher incomes, while infrastructure investment also creates many thousands of American jobs in the near-term." - The Whitehouse 2014, p.2

The United States is experiencing a modal shift from road to rail. Figure 2.30 from the US Department of Transportation Federal Railroad Administration report in 2010 shows that the average distance where rail becomes competitive with road is shortening. Effectively it anticipates an increased market share for rail over road for all distances greater than 250-499 miles with greatest change in the 500 to 1,000 mile trips.

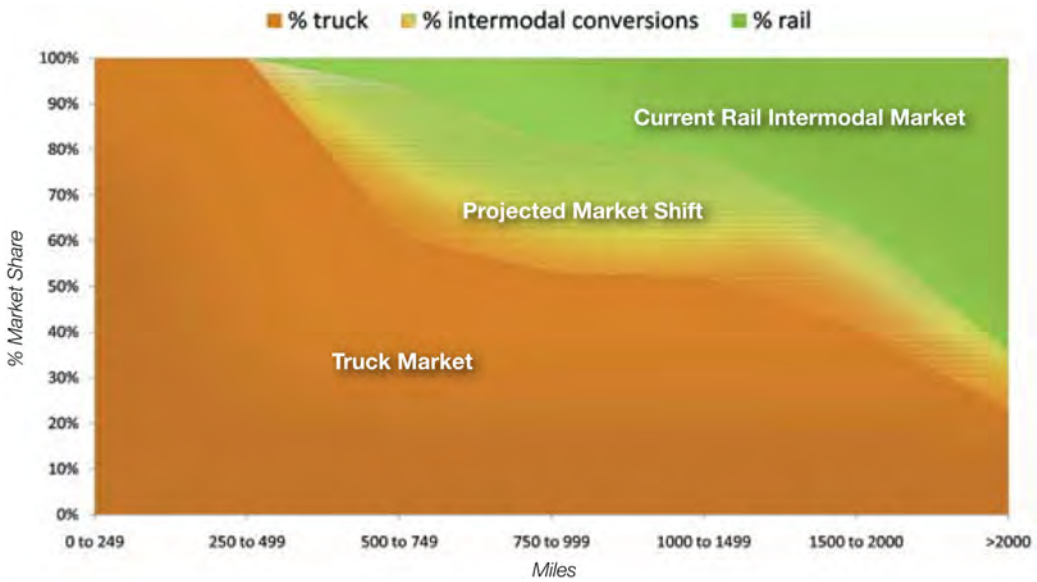

Figure 2.30: Potential truck to rail conversions (US Department of Transportation 2010, p. 20)

As mentioned earlier, the US Class 1 railways are mixed traffic. Table 2.23 shows the freight mix of these US Class 1 railways. Of note is that highest US Class 1 resource contribution is BNSF with 50.6 percent coal and the remainder of its cargo mixed freight. The US has set the best practice rail design as 32 tal track, capable of carrying double stacked containers.

Railway	Description	Freight mix (based on tonnage)	Total system length (km)
CSX	US East Coast mixed freight	41.9% coal	59,219 km
NS	US East Coast mixed freight	45.4% coal	58,083 km
CN	Northern US and Canada	17.0% coal, largest commodity is metallic ores at 37.5%	17,184 km
BNSF	US Central and West Coast mixed freight	50.6% coal	80,523 km
KCS	US South mixed freight	5.66% coal, largest commodities are petroleum and chemicals combined 40.7%	7,000 km
CP	Northern US and Canada	0.1% coal, largest commodity is grain at 35.5%	12,950 km
UP	US Central and West Coast mixed freight	47.3% coal	81,044 km
Aurizon	Mount Isa to Townsville Corridor	32% dangerous goods, 13% intermodal, 13% cement and fertiliser (based on qty Wagons)	967 km

Table 2.23: Mix of traffic US Class 1 railways compared against Mount Isa to Townsville corridor (Advisian 2015a)

The cumulative value of cargo on the US Class 1 railways is shown in Table 2.24 below. It is worth noting that some types of cargo on the US system provide a greater value revenue per tonne; particularly automotive and intermodal. A specific type of traffic here is defence cargo; most of this would be automotive and so be grouped in the highest value cargo.

Commodity	Revenue/Tonne	Revenue/Unit	Tonnes/ Unit
Automotive and Machinery	$124.30	$2,393	19
Intermodal	$69.90	$953 ($561/TEU)	14
Food and Consumer Products	$40.20	$2,590	64
Forest and Lumber	$39.90	$3,283	82
Pulp and Paper	$37.20	$2,344	63
Chemicals	$36.40	$3,148	86
Agriculture	$33.00	$3,094	94
Metals and Scrap	$31.30	$2,468	79
Stone, Gravel and Non-Metallic Minerals	$23.80	$2,405	101
Coal and Coke	$17.70	$2,052	116
Phosphate and Fertiliser Minerals	$14.10	$1,431	101
Iron Ore	$10.20	$872	86
Total	$31.90	$1,927	60

Table 2.24: Revenue per tonne of different products on US Class 1 railways (source: Surface Transportation Board c.2014)

2.3.5 Middle East

UAE

There is planning underway for the expansion of the rail network as the UAE attempts to facilitate access between Dubai and Abu Dhabi, together with other key rail infrastructure projects as the country aims to expand its freight and passenger capacity, and increased development in this is expected to facilitate a growth in the transport sector over the period from 2016 to 2025.

The UAE has invested heavily in boosting its transport infrastructure in the last few years, both to deal with the rapid population growth in Abu Dhabi and Dubai and to achieve the aim of positioning the UAE as a shipping, aviation and tourism hub.

The UAE rail network plans to support growth projections in passenger and freight movements. It is to be developed in three phases, linking the principal centres of population and industry of the states.

Etihad Rail was formed in 2009, and is charged with managing the development, construction and operation of the project. It is intended to form a part of the planned GCC railway network linking the six countries of the region: the kingdom of Bahrain, the State of Kuwait, Oman, Qatar, the Kingdom of Saudi Arabia and the UAE.

The initial phase of the UAE rail network stretching 264 kilometres is already complete, connecting the Shah oil and gas field with the industrial area and port in Ruwais, via Habshan. Plans for the second stage (628 kilometres) consist of connecting Ruwais to the Saudi Arabia border; Habshan to the ports of Khalifa and Jebel Ali, and a spur to Al Ain to connect to the Omani border. The third stage (279 kilometres) will connect the northern emirates of Fujairah, Ras Al Khaimah and Sharjah. The regional network will be 2,177 kilometres when complete.

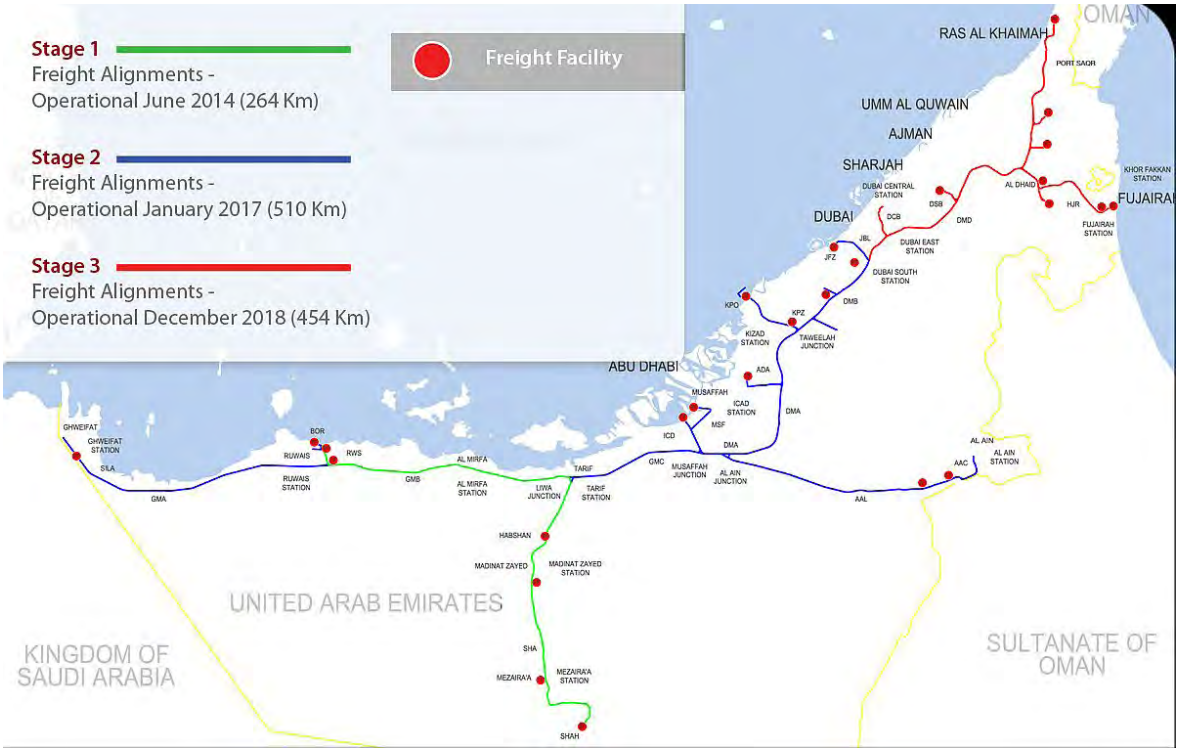

Figure 2.31: UAE Railway network (Deutsche Bahn 2016)

This infrastructure investment is part of an important business case to introduce an independent rail network alongside the planned Gulf Cooperation Council (GCC) developments which will provide a competitive advantage through supporting combined regional logistics hubs at Dubai and Abu Dhabi airports, as well as the Khalifa Industrial Zone (Kizad) and other industrial areas.

Saudi Arabia

Rail infrastructure is a key driver for growth in Saudi Arabia. The government invests heavily in public transport and logistical networks to meet demands of a rapidly expanding population and the cyclical influx of religious tourists. Coupled with a Kingdom plan to diversify the economy, an effective transport network is key for growth.

The rail sector holds the majority of the value of projects currently in planning or under construction in Saudi Arabia. Major expansion projects include the integral part of the GCC's Railway Network and developments in public transport infrastructure.

The major projects include the Saudi Landbridge and the Riyadh & Mecca metro systems.

Figure 2.32: Railway map of Saudi-Arabia peninsula (TunnelTalk 2017)

Qatar

Rail transport projects are currently underway in preparing Qatar for the World Cup 2022 with government eager to establish an integrated transport system and connect Doha to all other major cities, urban areas and energy and industry centres.

The Qatar rail project is an integrated rail system including the Doha Metro, the Lusail Light Rail Transit (LLRT) and a long distance passenger and freight line.

The 300 kilometre metro rail will service the capital and surrounding suburbs to bring all major locations within easy reach. The 38.5 kilometre LLRT network is being built to serve the residents of the planned Lusail City. The long-distance freight and passenger railway stretches 400 kilometres and is intended to form part of the planned GCC rail network.

2.3.6 Australia and New Zealand rail and port construction

The ARA's project pipeline reveals there is a strong outlook of projects in Australia and New Zealand, with a total exceeding $40 billion in rail projects in the next five years from 2016 (based on the available expenditure estimates), of which approximately $22 billion is committed funding.

This pipeline is shown in Figure 2.33.

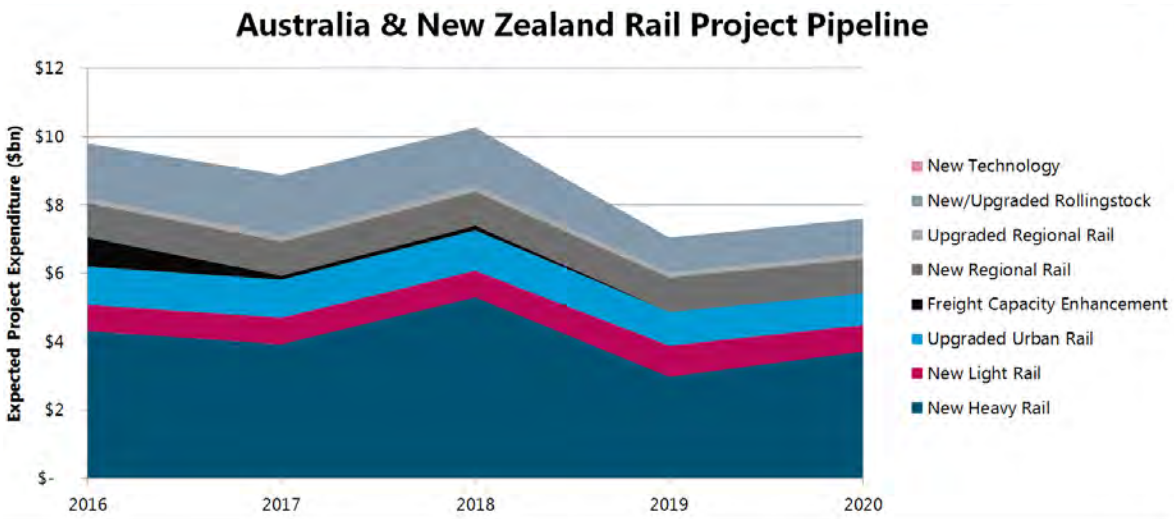

Figure 2.33: Australia and New Zealand rail project pipeline

It is worth understanding the nature of this rail spend by type of rail infrastructure. This is shown in Figure 2.34.

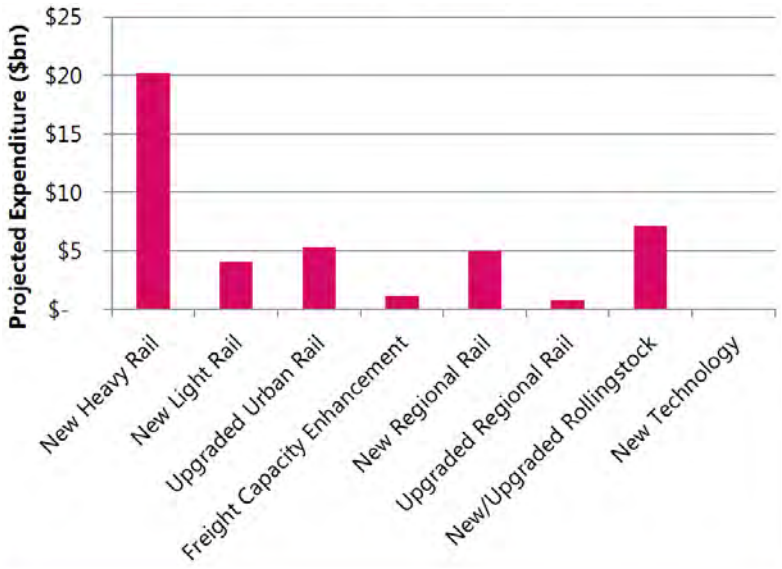

Figure 2.34: Nature of projected heavy rail investment

The largest contributor is new heavy rail, with highlights including Sydney's CBD and Southwest Metro ($11 billion), Brisbane's Cross River Rail ($4.5 billion), the Melbourne Metro ($11 billion) and ARTC's Inland Rail ($10 billion), although only the proportion of value in 2016-2021 are included in the figures above.

IBISWorld (Kelly 2015) projects that revenues for the Australian port and rail track construction (excluding rollingstock and non-track investment) industries will diverge. Falling port construction is driven by lower commodity prices and reduced mining investment, while steady growth in rail track construction is driven by freight and passenger needs. This data indicates that effective national logistic networks need to be based on a mix of traffic to be able to withstand industry cycles.

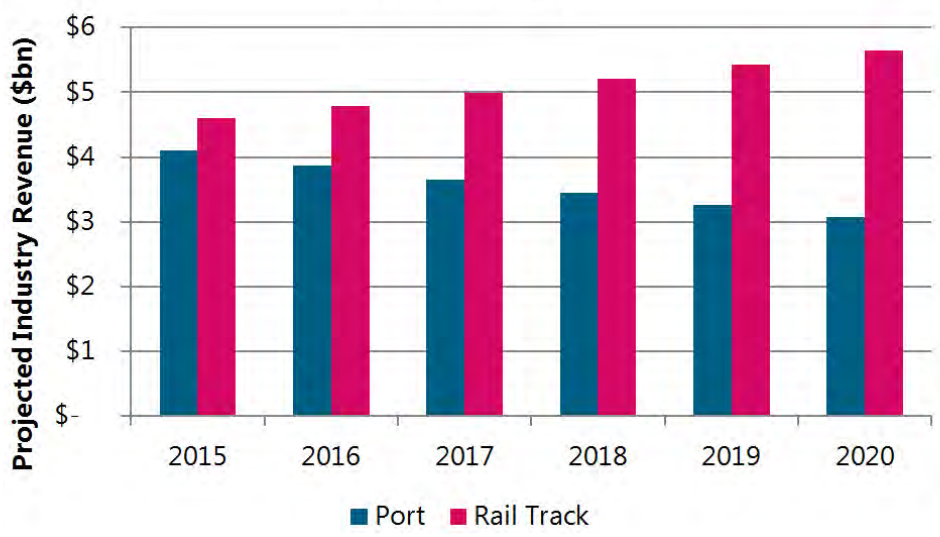

Figure 2.35: Port and rail comparative investment

Case study: Kenya and One Belt One Road

Situation

The East African rail network includes rail, road and pipeline corridors that connect east African countries like Ethiopia, Kenya, Tanzania, Zambia, Uganda and South Sudan.

The Kenya standard gauge railway is an ambitious project due to its size, complexity and expense. The aim of this new railway is to reduce congestion on Kenya's busy road network and to promote tourism.

The land-based Silk Road Economic Belt and the 21st-century oceangoing Maritime Silk Road are development strategies and frameworks proposed by Chinese paramount leader Xi Jinping. The purpose of these corridors is to connect and encourage cooperation among countries, primarily between the People's Republic of China and the rest of Eurasia.

Transport infrastructure such as railways, roads, ports and airports will be a particular focus.

Approach

The railway is being built by the state-owned China Road and Bridge Corporation (CRBC), 90% of the ongoing development of the Mombasa-Nairobi section is being financed by The Export-Import Bank of China.

The strategy, considered as One Belt One Road, underlines China's push to take a bigger role in global affairs, and its need for priority capacity cooperation in areas such as steel manufacturing. In order to fund the One Belt One Road initiative, three financial institutions were established in 2014 to support its development:

1. Silk Road Infrastructure Fund: a Chinese-led US$40 billion fund that invests in One Belt One Road infrastructure projects and is capitalized mainly by China's forex reserves
2. Asian Infra Investment Bank: aspires to be a global development bank with 21 Asian member countries and a registered capital of US$100 billion
3. New Development Bank: A BRICS multilateral development bank established by Brazil, Russia, India, China and South Africa. The bank was seeded with US$50 billion initial capital with intention to increase capital to US$100 billion. It is headquartered in Shanghai and each country is granted one vote, and no country has veto power

Result

The first section of the Kenyan standard gauge railway is nearly completed.

Relevance

Within Australia, enterprises, banks and law firms are promoting the One Belt One Road initiative as an economic opportunity for the country and, with Chinese endorsement, an Australia-China One Belt One Road initiative has been established to promote Chinese engagement in the Australian economy. China is also utilising the concept to promote its growing economic engagement with northern Australia. Another avenue for encouraging Australia's further engagement with OBOR is China's funding and support of various related local academic conferences and seminars.

Regardless of the credence which one assigns to the various interpretations of the One Belt One Road initiative, progress thus far makes it clear that, as Australia becomes increasingly tied economically with China, there is a need to maintain a close watch on the progress of the One Belt One Road global initiative.

It also suggests that Australia needs to adopt a more economically and strategically prudent attitude in determining how the Australia-China economic relationship is to further develop.